REPORT OF THE MAINE

ATLANTIC SALMON COMMISSION

TO THE MAINE LEGISLATURE

FISHERIES AND WILDLIFE COMMITTEE

FOR THE PERIOD

JANUARY THROUGH DECEMBER 2002

PREPARED BY:

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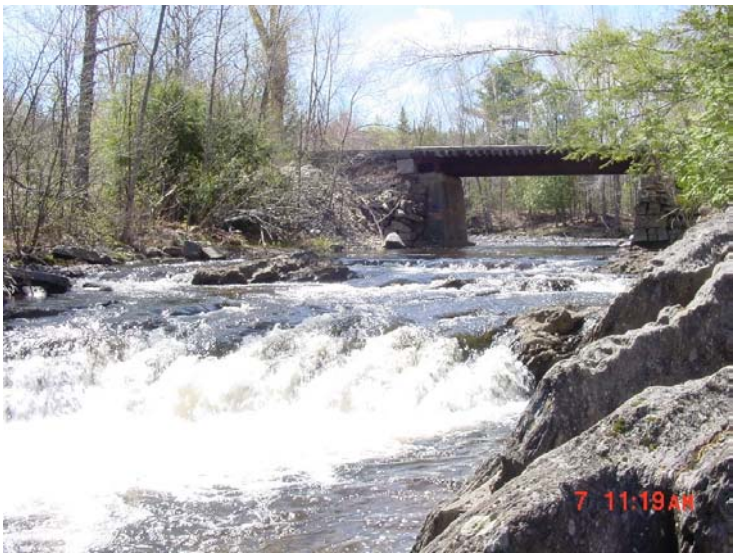
EXECUTIVE SUMMARY

The Maine Atlantic Salmon Commission (ASC) is charged with restoration and management of Atlantic salmon throughout its original range in the State of Maine. With a staff of 16 full time and 9 seasonal people in four offices, the ASC is involved with all aspects of Atlantic salmon research and management in coastal and eastern Maine.

Adult salmon are captured at the Veazie Dam on the Penobscot River by the ASC to supply brood stock to two Federally operated hatcheries at Craig Brook and Green Lake. These hatcheries, in turn, produce eggs, fry, parr, smolts, and kelts for the ASC to stock under a variety of protocols. Weirs or traps are operated on four salmon rivers (Penobscot, Narraguagus, Dennys and Pleasant) where fish are counted and examined. Those that are determined to be of aquaculture origin (escapees) are removed, and the rest are released upstream to spawn.

ASC staff also conducts electrofishing surveys to evaluate juvenile fish production in salmon rivers and to measure success of various stocking programs. Fall redd counts provide a direct measure of spawning activity by wild salmon. Habitat surveys by ASC staff are used to estimate carrying capacity for Maine rivers and suggest ways that habitats may be improved.

The ASC also manages the Atlantic Salmon Conservation Plan for Seven Maine Rivers (ASCP). This plan, developed to guide the State's procedures for protecting Atlantic salmon populations, has achieved significant advancement toward riverine and riparian zone protection on several Maine rivers. The ASC is working with two Federal Services (NMFS and USFWS) on developing a Federally mandated Recovery Plan for Maine's Atlantic salmon. Based on agency review many of the key tasks in Maine's ASCP are reiterated in the Federal Recovery Plan. The Federal Recovery plan is expected to be available for public comment in May 2002 and to be finalized by May 2003.



INTRODUCTION

Maine State Statute established the Maine Atlantic Salmon Commission (ASC) in 1999 [C.401, Pt. BB, § 8 (amd).]. This law replaced earlier legislation that formed the Maine Atlantic Sea-Run Salmon Commission in 1947 and, subsequently, the Atlantic Salmon Authority in 1995. The 1999 legislation structured the ASC with a three-member board comprised of the Commissioners of the Maine Departments of Inland Fisheries and Wildlife and Marine Resources and a third, at-large, member appointed by the Governor, subject to Senate confirmation. The Salmon Board appoints the Executive Director who is responsible for hiring and managing all other ASC staff.

The year 2002 was a very disappointing one for wild Atlantic salmon stocks in Maine. While the number of returning fish to the Penobscot River was similar to the previous year a very large percentage of those fish were grilse and thus mostly males. All other Maine rivers had a significant reduction in the number of fish returning from the ocean (see data within this report). Poor at-sea survival and below expectation production of wild smolts from Maine rivers are both significant factors affecting the ability of our rivers to recover toward self-sufficiency.

The Atlantic Salmon Conservation Plan for Seven Maine Rivers (ASCP) is also under the auspices of the ASC. An executive summary of ASCP activities can be found on page 2 of this report. The ASCP remains our operative guideline while we await the Federal Endangered Species Recovery Plan, due in spring 2002 but much delayed and still not available at this writing. The final report from the National Academy of Sciences is also not available at this writing and will, hopefully, provide recommendations for future Atlantic salmon management in Maine.

January 2003 will bring in a new Governor and associated new Cabinet Members to administer the State and the Commission. Hopefully current research and management efforts will also lead to a new future for Maine's wild Atlantic salmon.

Both the Executive Director and Policy Development Specialist positions were vacant at the end of 2002. An acting Executive Director has been appointed but both of these vacancies significantly impact the ability of the ASC to fulfill its charge. The newly appointed Salmon Board should make every effort to permanently fill these vacancies.

FUNDING

The ASC operates with a General Fund appropriation of approximately $807,000 (FY 2003) to fund monitoring, management, and enhancement activities. Included in this is an annual appropriation of about $144,000 to support staff and activities identified within the Atlantic Salmon Conservation Plan for Seven Maine Rivers (ASCP). These latter funds are spent to support efforts of the various watershed councils that are working to protect and enhance habitats along the DPS salmon rivers. Subsequent adjustments to all state agencies deducted $58,000 from the ASC general fund operating account. This has had the effect of reducing the amount of money available to support of the watershed councils and required that the ASC leave positions vacant after staff have moved out of state government. Additional budget reductions are expected for FY '03 and FY '04.

The ASC conducts various Atlantic salmon research projects in collaboration with, and financial support from, the National Oceanographic and Atmospheric Administration (NOAA). These projects include evaluation of various stocking practices, smolt migration studies, fishway effectiveness, etc. NOAA contracted with the ASC for about $937,000 in 2002 to perform these studies and it is expected that this amount may increase to about $1,120,000 in 2003. Most of the ASC staff are supported by this money. A separate Federal report is filed on these activities and is available from the ASC upon request.

The ASC received $2 million in non-lapsing Federal money in December 2000 to supplement funding previously received from the USFWS (United States Fish and Wildlife Service) and to enable the State of Maine to pro-actively address several of the issues identified in the Endangered Species Listing for Maine's Atlantic salmon. These activities include operation and maintenance for weirs on some of the Downeast salmon rivers, improving aquaculture activities, research into juvenile salmon survival, research on the impacts of irrigation on habitat and assistance to the agriculture community, hydrologic monitoring, staff support, and habitat protection.

The ASC also receives approximately $30,000 per year from the Kennebec River Restoration account. The ASC has hired and equipped additional staff with these funds and this has given us the ability to monitor salmon activities in the Kennebec and to evaluate the habitat suitability for future enhancement of this, Maine's second largest, river. All of the Kennebec River below Waterville and all the tributaries in this section have now been surveyed.

ATLANTIC SALMON STOCKING PROGRAMS

The ASC has the responsibility for all Atlantic stocking in Maine waters. The Commission does this in cooperation with two US Fish and Wildlife Service salmon hatcheries: Craig Brook National Fish Hatchery and Green Lake National Fish Hatchery. These hatcheries receive Atlantic salmon collected by the ASC from wild populations in Maine and hold or raise them for use as broodstock. Progeny of these fish are stocked by ASC at different ages.

The current salmon stocking program in Maine uses river-specific fish. Each river receives progeny of fish previously collected from the same river. This protocol is followed on the Sheepscot, Dennys, Narraguagus, Machias, East Machias, and Penobscot rivers. Atlantic salmon restoration in the Saco, Union, and St. Croix rivers is based on Penobscot River origin fish. At Craig Brook there are separate rooms where captured parr or smolts from the Downeast rivers are held through maturity when they are spawned. The embryos are reared to stock back into their natal rivers as fry, parr, or smolts. The adult fish are used as egg producers for one or more years, after which they too are returned to the rivers as kelts. The Penobscot River is the only river where eggs are taken from returning adults in addition to captive reared broodstock. Fry were the most numerous life stage of Atlantic salmon stocked into Maine rivers in the year 2002 (Table 1).

Adult Atlantic salmon are collected by the ASC at a trapping facility in the Veazie Dam on the Penobscot River throughout the spring and summer season. The fish are held at Craig Brook until sexually mature, stripped and the embryos incubated. Some are sent to Green Lake where they will be raised either to the parr stage or the smolt stage for stocking into the Penobscot River. More than 400,000 smolts were stocked in the Penobscot River in spring 2002 (Table 1). Under our cooperative agreement with the USFWS, about 50,000 smolts per year are sent to New Hampshire to support restoration efforts in the Merrimack River. Penobscot River eggs are also used to produce fry that will be stocked into various upstream reaches of the watershed where they will grow for two years before they too will migrate to the ocean as smolts.

In addition to the USFWS hatcheries there are three satellite hatcheries operated by non-governmental Atlantic salmon organizations; Union River, Saco Salmon Club, Atlantic Salmon for Northern Maine. The Union and Saco Hatcheries receive embryos from the Penobscot captive broodstock at Green Lake. Atlantic Salmon for Northern Maine receives embryos from St. John River stock spawned In Canada. These are reared and stocked in the Aroostook River. The Federal hatcheries also provide eggs to schools as part of an educational program called Fish Friends that integrates the task of rearing and stocking Atlantic salmon fry into the science curriculum.

Table 1. Summary of Atlantic Salmon Stocked in Maine in 2002 from USFWS hatchery broodstock, Fish Friends programs, St. Croix IWC, Dug Brook Hatchery, and Saco Hatchery*.

River Name	fry	0+ parr	age 1 parr	age 1 smolt	adult
Aroostook	122,000	-	-	-	50[1]
Dennys	84,000	33,000	1,900	49,000	-
East Machias	234,000	-	-	-	-
Machias	321,000	-	-	-	-
Pleasant	-	13,500	-	-	-
Narraguagus	274,000	-	-	-	-
Penobscot	865,000	396,700	1,900	547,000	1042
Sheepscot	172,000	-	-	-	-
Saco	586,000	-	-	4,000	-
Union	5,000	-	-	-	4[2]
St. Croix	470	-	-	4,000	-

**All numbers are provisional*
Numbers of fry are rounded to nearest 1,000.
Numbers of parr and smolts are rounded to nearest 100.
Adults are surplus brood fish from Craig Brook and are an actual count.

1. *These fish were captured on the St. John River and released into the Aroostook River as per standing agreements with DFO – Canada.*
2. *These fish were captured at the first dam in Ellsworth and transported upstream as per standing agreement with PPL.*

RESEARCH AND MANAGEMENT

The Atlantic Salmon Commission (ASC) staff conducts routine monitoring of the abundance and status of juvenile (Table 2) and adult salmon (Table 3) in most of Maine's Atlantic salmon watersheds. ASC staff operates traps to monitor adult Atlantic salmon returns on the Penobscot, Narraguagus, Pleasant, and Dennys Rivers. Great Lakes Hydro, America operates a trap in the upper Penobscot drainage, Pennsylvania Power and Light operates one on the Union River, Florida Power and Light operates traps and lifts on the Saco River, DMR operates one on the Androscoggin River, and the St. Croix Waterway Commission operates one on the St. Croix. Redd counts (Table 4) are used to track spawning escapement.

Table 2. Summary of juvenile Atlantic salmon population densities (fish/100m^2) in Maine Rivers, 2002.

Year	River	Young-of-the -Year				Parr			
		Minimum	Median	Maximum	Sites	Minimum	Median	Maximum	Sites
SITES with sufficient numbers of salmon to use multi-pass removal estimates									
2002	Dennys	0.0	1.9	16.3	24	0.0	1.9	13.4	24
	East Machias	0.0	5.5	32.9	8	0.0	4.2	9.5	8
	Kennebec	0.0	0.0	0.0	1	0.0	0.0	0.0	1
	Machias	0.0	3.8	26.1	11	0.0	3.4	19.6	11
	Narraguagus	0.0	4.3	18.6	28	0.3	2.2	8.0	31
	Pleasant	0.0	0.0	3.1	4	0.0	0.0	0.0	4
	Saco	0.0	11.3	78.7	9	0.0	3.5	14.5	9
	Sheepscot	0.4	15.9	34.6	4	4.9	5.8	51.5	4
SITES where low numbers of salmon were estimated based on a single pass									
Year	**River**	**Young-of-the -Year**				**Parr**			
		Minimum	**Median**	**Maximum**	**Sites**	**Minimum**	**Median**	**Maximum**	**Sites**
2002	Cove	0.0	0.0	0.0	3	0.0	0.0	0.0	3
	Ducktrap	0.0	0.0	0.0	3	0.3	0.4	0.8	3
	Eaton	0.0	0.0	0.0	1	0.0	0.0	0.0	1
	Felts	0.0	0.0	0.0	1	0.0	0.0	0.0	1
	Kenduskeag	0.0	0.0	0.0	86*	0.0	0.0	3.6	86*
	N Br Marsh	0.0	0.0	0.0	19	0.0	0.0	0.0	19
	Passagassawakeag	0.0	0.0	0.0	4	0.0	0.0	0.0	4
	S Br Marsh	0.0	0.0	0.0	4	0.0	0.2	1.8	4
	Sedgunkedunk	0.0	0.0	0.0	2	0.0	0.0	0.1	2
	Souadabscook	0.0	0.0	0.0	4	0.0	0.2	0.3	4

* parr were found at only 8 of the 86 sites in Kenduskeag Stream

Research on Atlantic salmon is directed at determining the causes of the precipitous decline in Atlantic salmon returning to Maine waters. Speculation on causes includes; global climate change, commercial fisheries in distant waters, marine and estuarine predation, contaminants that affect juvenile and smolt physiology, physically degraded freshwater habitat, and introduced competitors in freshwater. Ongoing ASC research projects are aimed at determining survival among freshwater life stages and understanding the biological and environmental factors affecting survival. NOAA-Fisheries salmon research is directed at the same questions for estuarine and marine waters. The two agencies conduct cooperative research designed to link freshwater rearing conditions and smolt emigration to better understand the biotic and abiotic factors affecting the freshwater-marine transition. Components of the cooperative projects are currently underway on the Pleasant,

Narraguagus, Dennys, and Penobscot Rivers. These include: parr density and growth, basin-wide estimates of large parr; indices or estimates of smolt emigration smolt; smolt physiology, marine and estuarine smolt trawling, and smolt tracking through estuaries.

ASC is investigating the effects of physical habitat and hydrology on juvenile salmon survival. This effort required ASC be involved in developing a network of USGS gages in Atlantic salmon rivers to increase the data available to link hydrology, habitat, and juvenile production and survival. ASC, USFWS, and USGS are cooperating on a project that surveys and catalogues stream channel geometry and determines bankfull discharge and channel characteristics at river reaches with productive Atlantic salmon habitat to gain understanding of the geomorphic processes. These data will also be used to build regional curves and a database of channel geometry that can guide natural channel design for construction of restoration projects in Atlantic salmon watersheds. In addition, USGS is documenting long-term trends in winter ice and spring runoff conditions for coastal Maine drainages. The next step will be to determine if these changes affected freshwater survival, and timing and success of smolt emigration. An IFIM study on the Dennys, conducted in 2002, increases the number of rivers to four where channel morphology, habitat quantity and quality, and hydrology can be linked to better model production. A series of workshops in 2001 and 2002 were the basis for USGS modifying the SALMOD model, to reflect the multiple years that juvenile Atlantic salmon spend in freshwater and multiyear spawning by adults. The model was calibrated using discharge, habitat, and temperature data for the Narraguagus River, and will be used to explore freshwater production under selected escapement levels and a range of hydrologic and climatic conditions.

Table 3. Return of Adult Atlantic salmon in 2002 as compared to previous years.

Drainage	1997	1998	1999	2000	2001	**2002**
St Croix	28	41	13	20	20	**20**
Androscoggin	1	4	5	3	5	**2**
Dennys	0	1		2	17	**2**
Narraguagus	37	22	32	23	32	**8**
Penobscot	1355	1210	968	535	786	**780**
Pleasant	1			3	11	**0**
Saco	28	28	66	49	69	**47**
Union	8	13	9	2	0	**5**
Aroostook	10	30	25	17	28	**7**
TOTAL	1468	1349	1118	654	968	**871**

USGS (United States Geological Service) Conte Anadromous Fish Research Lab is collaborating with ASC, PIN (Penobscot Indian Nation), NOAA-Fisheries, and the University of Maine, has begun research directed at understanding upstream migration of Adult Atlantic salmon in the Penobscot River. The research uses Passive Integrated Transponder (PIT) tag technology to gather data on movements of individual adult salmon that can be used to evaluate upstream movements and distribution of salmon within the drainage, the probability that fish are able to access spawning habitat, broodstock management, and the effectiveness of current juvenile stocking practices.

Table 4. Redd counts in Maine rivers in 2002 as compared to previous years

Year	1997	1998	1999	2000	2001	**2002**
Narraguagus	78	63	43	21	21	**6**
Dennys	35	32	23	60	71	**0**
Pleasant	1	9	0	1	3	**0**
Machias	59	74	42	23	21	**4**
Ducktrap	2	9	29	2	0	**0**
Sheepscot	8	4	18	15	18	**4**
Cove Brook	4	5	0	1	0	**0**
Souadabscook	0	4	1	2	0	**0**
Kenduskeag				2	0	**0**

What follows is a report on research conducted in association with stocking of adult Atlantic salmon reared in sea pens.

Gamete Viability Study:
Estimation of gamete viability and fecundity of river-specific marine net pen-reared Atlantic salmon in Maine.

Introduction

Atlantic salmon populations in Maine have been in decline for at least twenty years. Over the last hundred years, fisheries managers have tried many approaches to enhance or restore populations, but these efforts have not resulted in stable, wild populations of salmon. With the rapid decline in salmon abundance in recent years, and the addition of Maine Atlantic salmon to the Federal Endangered Species List, fish management has increased in intensity over the last five years. One of the approaches managers have taken was introduction of pen-reared adult salmon into their natal rivers in hope that these fish would spawn naturally and restock the rivers. These fish were reared by the aquaculture industry to adult size in marine net pens. The fish were stocked into the Dennys, East Machias, Machias, and St. Croix rivers in 2000 and 2001. The behavior and reproductive performance of these fish was monitored via ultrasonic telemetry, spawning surveys (redd counts) and subsequent fry trapping, redd excavation, and a reproductive success experiment.

The results of these efforts showed that these pen-reared adults achieved low reproductive success. This was determined from low numbers of redds constructed, very low numbers of fry found emerging from redds (although substantial numbers of fry were found emerging from some redds in the St. Croix in 2002), and low densities of young-of-the-year salmon in electrofishing surveys. These results were not necessarily unexpected. Many studies on various species of Salmonids, including Atlantic salmon, have found that fish reared domestically for part or all of their life cycles tend to display poor reproductive success when spawning under natural conditions in comparison to their wild counterparts. Although one explanation for the low reproductive success we observed was the low number of redds, this did not explain why we also observed very little production from the redds that were constructed. Based on this observation, we wished to test the hypothesis that gamete viability was limiting the reproductive success of these fish.

Methods

We moved 26 adult Atlantic salmon from Atlantic Salmon of Maine net pens to the Maine Center for Cooperative Aquaculture Research (MCCAR) in Franklin, Maine. The fish were of Dennys, Machias and Sheepscot stock. The collection of fish was treated as a mixed-stock in this study and no attempt was made to perform spawnings within a stock because stock-specific tags were visible in only four fish. Shortly after the fish arrived, we sampled them to determine sex and state of sexual maturity, obtain a tissue sample (fin clip), and measure fork length. We checked the fish for sexual maturity at least once a week, and more often as they matured.

We performed spawning by manually stripping eggs and milt. We checked sperm motility by activating a sample of milt with water and observing under a compound microscope. We estimated fecundity of each female by estimating the weight per egg and

then extrapolating the number of eggs in the entire egg mass. We mixed eggs and milt in 5-gallon buckets with a minimum of water and then transferred the eggs to Heath trays and incubated in a flow through system.

We estimated survival to the eyed-egg stage by estimating the number of surviving eggs in the same manner fecundity was estimated and dividing by the original fecundity. We planted eyed-eggs in the St. Croix drainage (in the main stem and in Little Simsquish Stream). We retained a portion of the eggs (eight families and approximately 1000 eggs per family) to rear to the fry stage in the hatchery and transferred these fish from Heath trays to flow-through, shallow fiberglass tanks as alevins.

We planted eggs in the St. Croix drainage by manually digging pits in the substrate with shovels and grinding our boots in the substrate, and also using a commercially made egg-planting device. We deposited eggs into the pits via the egg-planting device that served as a conduit to place eggs with precision. We then covered the pits with gravel. Planting conditions were difficult because the river was iced over and there was very little open water. We attempted to plant eggs in many separate "redds" to minimize planting at too high a density.

After planting the eggs, the alevins remaining in the hatchery experienced rapid mortality. The cause of this mortality was not apparent. To investigate the cause of this mortality, MCCAR staff took water and pathology samples. Analysis of these samples did not identify a cause of this mortality. Due to this rapid die off, we chose to move the remaining fish to a Living Stream (closed aquarium system) in the Maine Atlantic Salmon building in Jonesboro, Maine. The fish continued to die after transporting to the Living Stream, but the mortality subsided after several days. We fed the remaining fish until spring, and stocked them as fry in the St. Croix drainage.

Results

Descriptive Fish Data

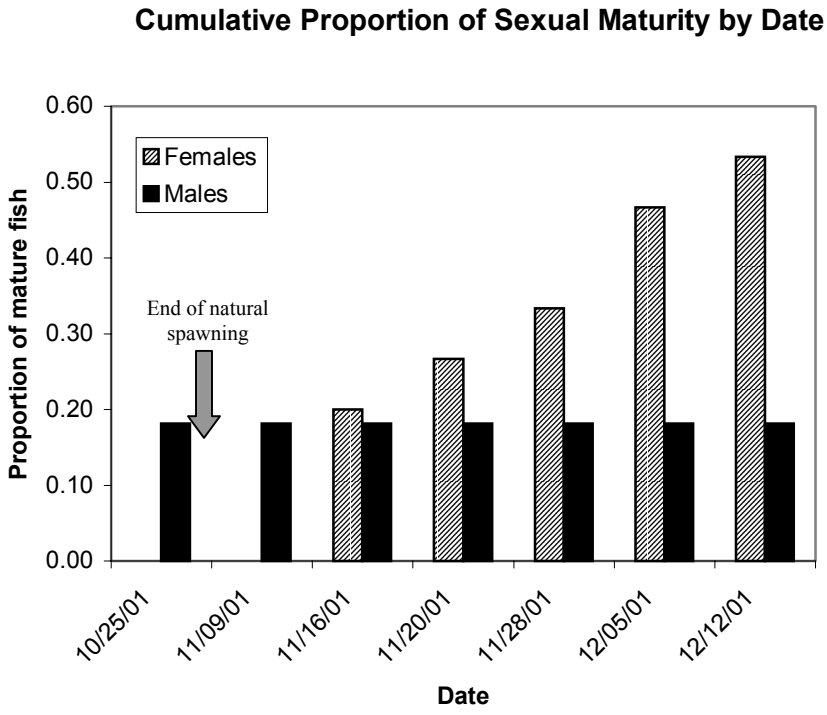
On 25 October 2001 we sampled the adult salmon for the first time. The male to female sex ratio was 0.42, with 11 males and 15 females. Males were significantly longer than females ($p < 0.002$) with a mean length of 355 mm (sd 20.7) compared to 332 mm (sd 13.5). Average fecundity of females was 12,892 eggs (sd 2388). We were able to identify stock-specific Visual Implant Elastomer tags in only four of 26 fish.

Sexual Maturity Rates

Sexual maturity occurred late in the season and at a low rate. Only 18% (2 of 11) of males and 53% (8 of 15) females matured sexually over the course of this study. Both males were mature upon arrival at MCCAR and these were the only males to achieve sexual maturity during the study. No females were mature at time of arrival, and maturation was slow and incremental over the course of the study. No females matured before the week of November 16. Median spawn data (n = 8) was November 24, approximately three weeks

after natural spawning in the Maine rivers would typically commence. The last female matured the week of December 12 (Figure 1).

Figure 1.



Spawning

We performed 16 spawnings, producing 15 half-sib families. One female was spawned twice with the same male on two different dates. Fertilization rates were high with a mean of 97% (sd 4.9). One female produced fertilization rates of 85% with both sires, suggesting that the lower rates were due to the dam. Sperm was always motile, but displayed both high and low motility on different days. This may be an artifact of our methods since sperm motility did not affect fertilization.

Survival

Survival by family to the eyed-egg stage was 83.8% (sd 16.6) with a high of 100% and low of 58.5%. Survival at the rate of 100% was an artifact from error when estimating numbers of eggs at spawning and shocking. In the three cases where survival exceeded 100%, we capped the survival rate at 100%. There was no significant difference between the survival rates of families sired by the two males (paired t-test, $n = 4$, $p > 0.419$).

Egg planting

We planted eyed-eggs in January 2002 in the St. Croix drainage. We planted 32,998 eggs in Little Simsquish Brook, a tributary to the St. Croix River, and 10,629 eggs in the main stem St. Croix, approximately 400 m upstream of the Little Simsquish confluence on 3 January 2002. On 17 January 2002 we planted approximately 34,969 eggs in the main stem of the St. Croix River downstream of the Woodland Dam in Baileyville. We attempted to monitor the survival of the eggs we planted in Little Simsquish Brook by placing a drift sampling net downstream of the eggs we planted in the spring. High water and the remote location of this site made this effort impossible. The net was continually filled with debris and did not fish properly. We did not capture any emergent fry. However, sampling by backpack electrofishing later in the summer in Little Simsquish revealed that young-of-the-year salmon were present at a one-run density of 12.14 YOY/unit. These fish could have moved into Little Simsquish from the main stem, but it seems likely that they were the result of our egg planting.

Rearing Beyond Eyed-Egg Stage

We retained approximately 500 fish from each of eight families to rear to the fry stage (total 8116). As the fish neared the late stages of yolk absorption they began to die suddenly and unexpectedly. We could not identify a cause. To further investigate, pathology samples were analyzed by Microtechnologies Inc. (Maine) and water quality samples were analyzed by the University of Maine, Orono and Maine Department of Health and Human Services. No likely cause of mortality was identified from either pathology or water quality. As a means to save the remaining fish, we moved survivors to a Living Stream at the Atlantic Salmon Commission office in Jonesboro. Although fish continued to die in the living stream, the death rate subsided rapidly and eventually stabilized to a low level.

Fry Stocking

We stocked the surviving 200 fry from the Living Stream in Haycock Bog Brook, a tributary of the St. Croix River, on 12 April 2002. We did not attempt follow-up sampling for growth or survival because of the small number we were able to stock.

Disposition of Adult Study Fish

Adult study fish were released in the lower St. Croix in accordance with the Maine Technical Advisory Committee policy on releasing of adult broodstock. Fish were released in tidal waters in Calais, Maine on 17 December 2002 (13 fish) and 20 December 2002 (13 fish). All adult fish in the study survived to release and appeared to be in good condition.

Discussion

Findings indicate that gamete viability is probably not an important factor contributing to the low reproductive success of pen-reared river-specific salmon, but maturation rates and timing appear to be important factors. High fertilization rates, at least 95% for all families, except for families of one dam, and typical survival rates to the eyed-egg stage (mean 83.8 %) for salmon eggs incubated in a hatchery indicate that there was not a problem with the gametes of these fish. However, the low rates and late timing of sexual maturity among both males and females indicate that spawning in the wild may have been at a lower rate than expected due to a paucity of sexually mature fish, and that spawning well past the window of natural spawning may have reduced the reproductive success of those fish that did sexually mature and spawn. Salmon that have been reared under domestication have been shown to achieve lower reproductive success than their wild counterparts due to a variety of reasons. If the pen-reared fish stocked in Maine carried some of the traits that hinder reproduction in the wild and also matured late and at a low rate, their reproductive capacity would be severely hampered.

We do not know why fish we retained in the hatchery to rear to the fry stage died suddenly. We found no obvious reasons for this mortality by observing the fish, pathology testing, and water testing. There did not appear to be any system failures at the hatchery. One possible explanation is that these fish carried a genetic trait that predisposed them to sudden early mortality. This is unlikely because the parental population was composed of fish from different populations (rivers), and we observed the phenomenon across all eight families that were present in the hatchery at this time. In addition, when we moved the surviving fish to the Living Stream at another location, the mortality rate appeared to decrease and ultimately settled at a low rate. We were then able to maintain approximately 200 fry to stock. Unfortunately, only two males sired all the families, and if both males' offspring carried a fitness problem, this could explain the results we saw. However, when we moved the surviving fish to the Living Stream at another location, the mortality rate appeared to decrease and ultimately settled at a low rate. We were then able to maintain about 200 fry to stock. This suggests that the problem was environmental, although the same number of fish may have ultimately survived at MCCAR.

Planting eyed-eggs in Maine does not appear to be a viable management strategy, although it may be useful for research purposes. In Maine, eyed-eggs become available in January or later in the winter. At this time of year, rivers are typically frozen and locating open water in which to plant eggs is unreliable. Furthermore, any open water that does exist may not be in suitable locations for egg planting and incubation. In addition, it is time intensive to plant eggs and winter conditions place workers at increased risk. We were not able to monitor the success of the eggs we planted to the degree we desired. Our attempt to trap drifting fry in Little Simsquish Brook failed due to frequent high water and remoteness of the site. We did not attempt to trap fry in the main stem sites because of the large size of the river. Subsequent electrofishing in September showed a robust young-of-the-year density in Little Simsquish Brook. This density suggests that these fish likely came from the eggs we planted, particularly since natural redds in this area revealed very low reproductive success, and there was no natural recruitment in Little Simsquish Brook.

Future enhancement efforts that use adult salmon as natural spawners should not be attempted before issues of maturation rates and timing are resolved. In addition, methods of rearing should be researched to optimize not only the timing and rate of sexual maturity, but also other to address other traits identified in the literature such as courtship failure by males, poor competitive ability, and other behavioral traits that deviate from wild salmon.

In memory of
Bill O'Coin

Whose professionalism made this study possible, and whose good humor made it a pleasant task.

WATER QUALITY MONITORING

By Mark Whiting, Ph. D. Maine DEP
(Summary by R. Dill, ASC staff)

2002 Sample Plan

In 2002, the Maine Department of Environmental Protection and volunteers from the Salmon Rivers Watershed Councils concentrated water quality monitoring efforts on characterizing major storm water and snow melt events. Turbidity, pH, and other non-point source (NPS) pollutants were monitored on the Narraguagus River, Pleasant River, Machias River, East Machias River, Dennys River, Sheepscot River, Ducktrap River, Cove Brook, and their tributaries. Sampling methods included real time field measurements; grab samples which were analyzed at the University of Maine George Mitchell Center for Environmental and Watershed Research: and the use of six Yellow Springs Instruments (YSI) data sondes which were deployed during the summer and fall of 2002. Two were in the Sheepscot River and four were on tributaries of the Machias River (Old Stream, Big Springy Brook, and Sam Hill Brook) and in Venture Brook (a tributary of the Dennys River).

Results for 2002

Turbidity

Most salmon rivers and tributaries had very low turbidity. The exceptions were the Sheepscot, Cove Brook, and one early sample from the Narraguagus. The turbidity values observed at these three sites could cause short-term interruptions in normal behaviors of salmon fry and parr.

Aluminum

Total and dissolved aluminum were abundant in storm water events on all of the sampled salmon rivers. The highest aluminum values were found in Tunk Stream, Bear Brook, Big Springy Brook, Pembroke Stream (in the Machias drainage), and Rocky Brook (East Machias River). Consequences to salmon of the observed values could result in osmotic stress, difficulty smolting, and mortality.

pH

Spring and fall acidification events were observed in Tunk Stream, Pleasant River and the Narraguagus River. Acidification events were also observed in the spring in the Machias River and Old Stream. As expected, tributaries were more likely to be affected than larger streams and rivers. Of the tributaries assessed this spring, 12 out of 13 tributaries to the Machias River, and 4 out of 8 on the Narraguagus River have seasonally acidic conditions below pH 5.8.

Plans for 2003

Plans for 2003 include more individual storm water and high runoff (snow melt events) sampling, increased fall sampling to investigating pH episodes, complete tributary water quality assessment, more sampling on the Pleasant River and East Machias River and their tributaries.

A complete copy of Mark Whiting's report may be obtained by request from the ASC offices in Bangor.

PROJECT SHARE

Prepared by Steven Koenig, Project SHARE Executive Director

The following is a summary highlighting Project SHARE activities for the year 2002:

NPS Site Restoration

- An ad hoc "habitat restoration" committee was formed. The committee serves as a working group specifically identifying tasks associated with local habitat restoration activities. The working group developed a strategy to priorities restoration projects in each watershed using information compiled the SHARE GIS database that will become part of a manual addressing restoration activities.
- Restoration of 20+ sites in the Machias Watershed was completed below budget. SHARE also surveyed and documented the success of last year's restoration activities in the Machias Watershed. A worksheet was designed by Gregg Beane (DEP) to document sites post-restoration. It will become part of the Restoration Working Group's manual.
- Restoration of 6 sites in the Dennys River Watershed was completed. The remainder of the project will be completed in 2003.
- Construction of the bridge at Munson Rips was completed. The location was being used as a ford by off road vehicles. WCSWCD was the lead for the project. Partners included E. Machias/Machias Watershed Councils, SHARE, Department of Conservation, several local ATV & snowmobile Clubs.
- Construction of the bridge at Sinclair Barrens was completed. Partners included: SHARE, Narraguagus River Watershed Council, Department of Conservation, and several local ATV & snowmobile clubs. Funders included: NFWF, USF&WS, and Department of Conservation. In addition to the bridge, International Paper restored several NPS sites on a portion of the trail leading to the bridge site that no longer will be used. The Narraguagus River Watershed Council restored additional NPS sites on a portion of the trail that crossed the Small property.

Riparian Buffer Planting

- Machias River – Twenty-six volunteers planted 1200 red pine and black spruce and 1000 willow trees in three locations. One hundred and Eight hours were contributed to this effort. Partners included: Washington Academy, Project SHARE, Washington County Soil and Water Conservation District, NRCS, Machias River Watershed Council, E. Machias River Watershed Council, Atlantic Salmon Commission, The Nature Conservancy, University of Maine at Machias, Downeast Salmon Federation and International Paper.
- Pleasant River – Twenty-five volunteers planted 750 black spruce, 6 flowering crab, 50 white cedar, 15 white pine and 50 sugar maple on property owned by the Pleasant River Fish and Game Club. Eighty-four hours were contributed to the project. Partners included Project SHARE, Washington County Soil & Water Conservation District, NRCS, Pleasant River Fish and Game Club, International Paper, Pleasant River Watershed Council, and County Corrections.

- Old Stream - Eight volunteers planted 110 black spruce, 40 white cedar, and 50 sugar maple in the old Route 9 corridor adjacent to Atlantic salmon spawning habitat. Thirty-five hours were contributed to the project. Partners included Washington Academy, Project SHARE, Washington County Soil and Water Conservation District, and the E. Machias and Machias River Watershed Councils.
- A wetland plant nursery has been constructed at Washington Academy (Machias, ME). Students at Washington Academy will propagate and raise wetland and upland plant for use in restoration projects. The water distribution system remains to be installed. **NOTE:** Mr. Sprangers and 5 students from the Environmental Studies Program represented the State of Maine in Washington, DC as part of the 30th Anniversary of the Clean Water Act. Their presentation depicting their involvement in Atlantic Salmon Restoration activities (including the WA Nursery Project) was awarded 1st place in a nationwide competition. Of specific note was the wide range of partners collaborating on salmon restoration activities.

Research Committee

- The Research Committee has provided funding to send local volunteers for training to two workshops: 13th Annual NPS Conference in Boothbay (4 people), and the Geofluvial workshop in Augusta (6 people).
- The Research Committee hosted a public forum on the use of Velpar and other pesticide/herbicides in the blueberry industry.
- The committee provided funding for repair of water quality monitoring equipment and the cost of water quality sample analysis.

Education Committee

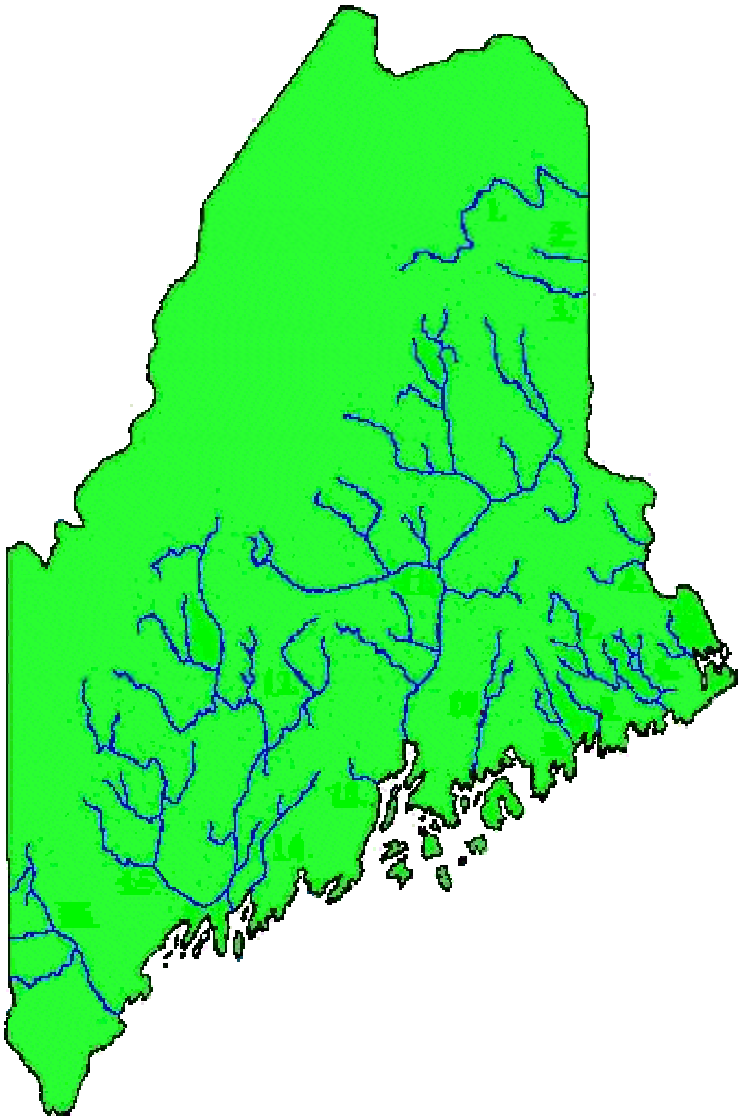
- The committee hosted a "Got Water" public forum that dealt with water use issues.
- The committee provided funding to support salmon related activities at the University of Maine at Machias.

ATV Working Group

- The ATV working group is interacting with local ATV clubs. Efforts are underway to provide educational outreach to this user group and to include them in Watershed Stewardship activities. Products from this group include: an educational brochure addressing Atlantic salmon and landowner issues, signage focusing on sensitive habitat awareness, and a power point presentation for presentation to area ATV clubs. The featured message will be conservation awareness and stewardship while enjoying recreational riding on private property. It is also intended as a training device to develop and work with trail stewards. The intent is to train some ATV riders to identify and report NPS issues associated with the trails.

Individual River Reports

Summaries of Management and Enhancement Activities



Aroostook River

The Aroostook River is located primarily in Maine, but it is a tributary to the Canadian St. John River system, which enters the Bay of Fundy at the city of Saint John, New Brunswick. Management of Atlantic salmon in the Aroostook River is an international effort between the Maine Atlantic Salmon Commission (ASC), the Canadian Department of Fisheries and Oceans (DFO), Maine Dept. of Inland Fish and Wildlife (MDIFW), New Brunswick Dept. of Natural Resources (NBDNR), and a non-government organization the Atlantic Salmon for Northern Maine (ASNM).

2002 Activities

1. Population Monitoring

a. Adult Trap Operations

Mactaquac Dam. The Canadian DFO operated a fish trapping and sorting facility on the St. John River at Fredericton, NB. Returns of MSW (multi-sea-winter aged) salmon were the lowest ever recorded (380 MSW salmon) and were 80% below the 5-yr average (1995-19999). Below average MSW returns had been anticipated in 2002 due to poor 1SW (one-sea-winter aged, aka grilse) returns the previous year. Returns of 1SW (2327 grilse) improved by over 39% compared to 2001, and is predictive for increased MSW returns in 2003.

Tinker Dam. PDI Canada, Inc. operated a fish trapping and sorting facility at their Tinker Dam Hydro Project on the Aroostook River in New Brunswick under an agreement with ASNM. The Tinker trap catch followed the decline observed at the Mactaquac trap and only 7 salmon (1 MSW and 6 1SW) were observed compared to 28 fish (14 MSW and 14 1SW) in 2001.

b. Electrofishing

Electro fishing surveys were not attempted in 2002.

2. Population Enhancement

a. Stocking

Juvenile Salmon. Approximately 120,000 Atlantic salmon fry were distributed in the Aroostook River between Masardis and Fort Fairfield by the ASNM. These fry were produced from the eggs of sea-run Atlantic salmon captured and held as broodstock by the DFO at Mactaquac. Importation of the eggs in 2002 was facilitated by a new disease screening protocol developed and implemented in 2000

Adult Salmon. DFO transported 50 sea-run grilse (49 male, 1 female) captured at the Mactaquac fish trap to the Tinker headpond near the Maine-New Brunswick border as per standing agreement with ASNM

b. Broodstock Management

The strategy developed in 2000 to individually test all broodstock at Mactaquac for disease, and incubate eggs from each spawning in isolated lots has been adopted as the standard operating practice. This procedure permits the segregation of healthy eggs from potentially diseased eggs, and increases the likelihood that eggs will be available for importation to the Aroostook program. The number of sea-run broodstock allocated for Aroostook egg production, typically 25 males and 25 females, was reduced by 28% in 2002 as a result of record low adult returns to Mactaquac. A total of 18 MSW females were spawned with 18 males in November 2002 to produce an estimated 150,000-eyed eggs for transfer to the ASNM Dug Brook Hatchery early in 2003. The DFO and IFW are currently conducting the required disease testing of all Aroostook/St. John broodstock and results are expected in early January. The ASNM provided funding and contracted with the DFO to captive rear additional broodstock for the Aroostook program. Approximately 50% of the first captive broodstock cohort from this program matured as "1SW equivalents" in 2002, producing an estimated 200,000 additional eggs for the Aroostook program in 2003.

Captive Broodstock Program Development. In March of 2002, members of the ASNM addressed the ASC board to request assistance in acquiring additional Atlantic salmon eggs for the Dug Brook Hatchery. In response, the board directed ASC staff to identify and evaluate potential alternatives including a review of existing facilities and new hatchery construction. Based on those findings, the board determined that expansion of the captive broodstock production program at Mactaquac was the most cost effective approach. The board voted to secure funding for additional broodstock development costs in 2003 at Mactaquac, and (pending fund availability) continue support in future years. The result will be to double the current captive egg production to 2 million eggs for ASNM and the Aroostook River program.

3. Habitat

a. Habitat Surveys

Habitat surveys in 2001 focused on the mainstem of the Aroostook River between Ashland and the Washburn area. In 2002, a team of three-four biologists surveyed the lower 15 miles of the Little Madawaska River, including areas above and below the water storage dam operated by the Loring development authority. These data are currently being analyzed.

b. Water Quality

During execution of the Little Madawaska River, staff identified an irrigation pump station located in high quality salmon habitat that was constructed and operated in violation of DEP water quality protection regulations. Staff provided photographs, GPS coordinates, and a narrative description of the site to the DEP.

The ASNM succeeded in having the confluence of Merritt Brook dredged to restore the stream channel which had been altered by erosion and sediment deposits. The action was undertaken in an effort to improve fish passage in to this cold-water tributary.

4. Fish Passage

a. Monitoring Fishways.

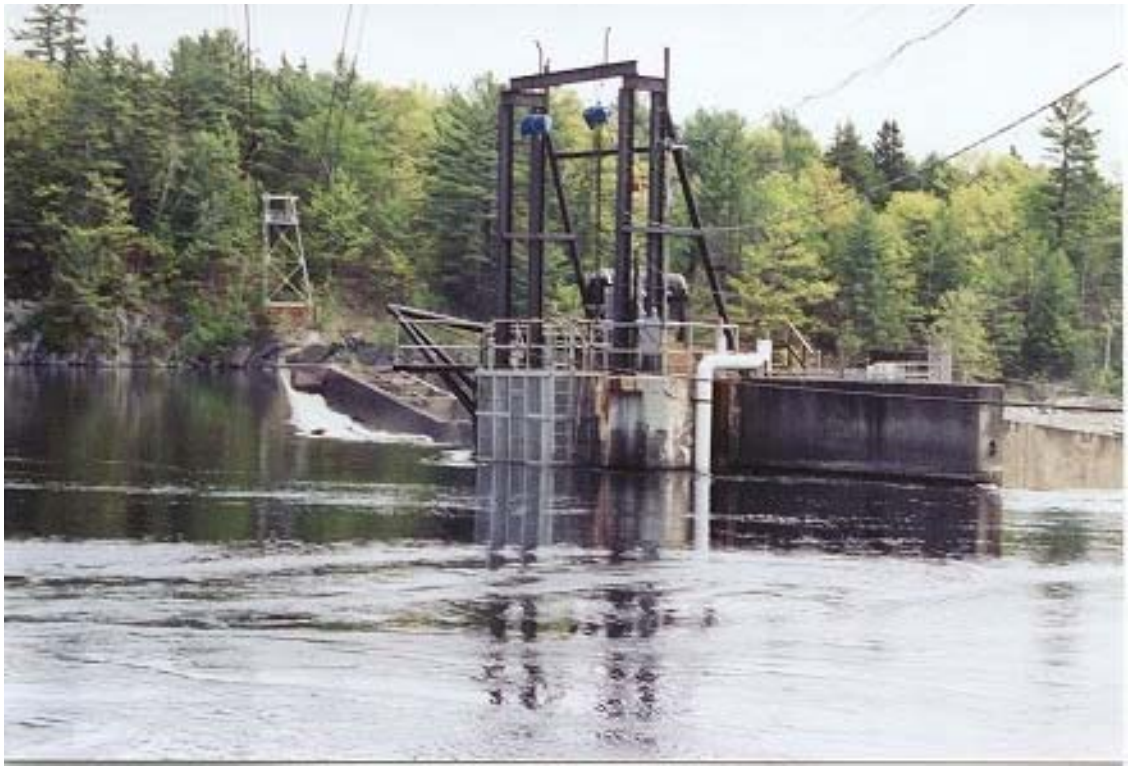
(see section 1.a.)

b. Fish Passage Consultation and Review

The USFWS in consultation with the ASC is exploring options to obtain federal grants that may be applicable to repairs at the fishway at a dam on the Little Madawaska River. The impoundment created by the dam serves as the primary water source for the Loring property and is considered vital to the long-term development goals of the LDA. Transfer of dam ownership from the U.S. Air Force to the LDA was finalized in 2000.

5. Public Meetings and Outreach

ASC staff attended Aroostook River meetings with the Atlantic Salmon for Northern Maine organization, Aroostook River Advisory Council, and with the international St. John River Advisory Committee in St. John, New Brunswick.



Cove Brook

Cove Brook is located on the northern edge of Waldo County; one of its small tributaries, Baker Brook, originates in southern Penobscot County. It is the smallest of all the listed salmon rivers in Maine. Cove Brook is a small tributary to the Penobscot River estuary located approximately 13 miles below the Veazie Dam (head of tide). Cove Brook flows approximately 16.5 km from its headwaters and drains a watershed of only 9.5 square miles in Winterport and Hampden. The National Marine Fisheries Service (NMFS) and the U. S. Fish and Wildlife Service (USFWS) listed the Atlantic salmon population in Cove Brook as endangered on November 13, 2000. ASC staff conducted the following enhancement and management activities on Cove Brook in calendar year 2002.

Activities

1. Population Monitoring

a. Electrofishing

Juvenile salmon populations were surveyed by electrofishing at three sites on Cove Brook. The Pipeline and Back Winterport Road index sites, as well as the gravel pit area, all located in Winterport, were sampled in October anticipating higher water levels and cooler temperatures. There were no young-of-year (YOY) salmon or parr found at any of these sites in 2002.

b. Redd Counts

There were three attempts to find redds in Cove Brook in 2002 (October 31, November 13, November 20). No salmon digging activity was observed during any of the survey periods. Summer long low flows in Cove Brook likely limited access for adult salmon to upriver spawning grounds. On October 17, fall rains began at which time water levels rose allowing the migration of adult salmon into Cove Brook.

2. Habitat

a. Property Purchases or Conservation Easements

The Cove Brook Watershed Council, incorporated January 2001, meets monthly and is in the process of developing a watershed management plan. The plan will address the many environmental issues encountered within the Cove Brook watershed. In addition, the plan has been submitted to the State Planning Office in November 2002. Work will take place over the spring and summer of 2003, and the final report will be completed by fall of 2003. The Council, having acquired tax-exempt status as a non-profit organization, will be able to hold land through conservation easements.

b. Obstruction Surveys and Removal

Three obstruction surveys were conducted on Cove Brook during October on the 8th, 15th, and 21st to identify Atlantic salmon passage problems. A number of obstructions that blocked fish passage were observed between Baker Brook and the gravel pit near the Back Winterport Road. Extremely low flows throughout summer and early fall compounded

passage at many of these obstructions. Six beaver dams were breached on three occasions within this reach to provide passage and additional water flow to the lower river. On one occasion debris was removed to allow fish movement above the Baker Brook area. The Council provided additional assistance removing debris.

c. Water Quality

ASC recorded summer water temperature on Cove Brook at three sites: gravel pit, Back Winterport Road, and Pipeline. The MDEP also collected water quality data from Cove Brook, consisting of storm water run-off and base flow water conditions. In addition to the summer collection of water temperature data, the ASC will also collect temperature data at one location throughout the upcoming winter months. All data will be analyzed during the winter and spring of 2002 – 2003 and will be available in late spring by contacting the ASC.

3. Meetings

ASC Biologists attended monthly Cove Brook Watershed Council meetings; participated in volunteer training activities; as well as work plan preparations for the watershed management plan.

Dennys River

The Dennys River is located in eastern Washington County. Beginning at Meddybemps Lake it flows approximately 32 km to its confluence with Cobscook Bay in the Town of Dennysville. Cathance Stream is the only major tributary. The Atlantic salmon population was listed as endangered by the National Marine Fisheries Service (NOAA-Fisheries) and the U. S. Fish and Wildlife Service (USFWS) on November 13, 2000. The ASC conducted the following enhancement and management activities during calendar year 2002.

1. Population Monitoring

a. Adult Weir Operations

A weir, located at the head of tide in Dennysville, was operated from 20 April through 13 November 2002 to trap upstream migrating salmon for the purposes of evaluating the size of the wild run and to intercept escaped aquaculture fish. We captured a total of six salmon. Two one sea-winter fish originating from smolt stocking in Spring 2001 were captured and released upstream after measuring length, and taking scale and tissue samples. We sacrificed four suspect aquaculture fish captured in the trap in accordance with ASC protocols. These salmon were photographed, weighed, measured, scale sampled, tissue sampled for genetics and disease, and evaluated for sexual maturity.

b. Electrofishing

We electrofished 28 sites in the Dennys River drainage, collecting population estimate data for juvenile salmon at 25 sites, with three additional sites to collect parr for captive broodstock. The population estimate data collection efforts were structured around a Basin-wide Geographical Population Estimate (BGEST) sampling design. The drainage was divided into environmentally similar strata and electrofishing sites were randomly chosen within these strata. This approach allows us to more accurately estimate the juvenile population in the river and better evaluate the effects of environmental factors and management approaches on the juvenile salmon population.

Preliminary analyses have been completed for 2001 and 2002. Results indicate that the standing crop of Atlantic salmon parr in the Dennys River was 4833 in 2001, and 3837 in 2002. However, in 2002, approximately 18% of the parr we captured (678) were from a stocking of parr the previous fall. This indicates that production in the river is lower than the overall 2.2 parr/unit. Density of young-of-the-year (YOY) has been extremely low in 2001 (median 0.34 YOY/unit) and 2002 (median 1.88 YOY/unit) in spite of stocking fry and releasing adults into the system.

c. Telemetry

We assisted NOAA-Fisheries in retrieving and deploying six VR-2 ultrasonic receivers in the Dennys River. These units were used to track movements of adult salmon tagged the previous year, as well as the movements of smolts stocked in the river. NOAA-Fisheries is currently analyzing these data.

d. Reproductive Performance Evaluation

We attempted to trap emergent fry in six redds from April through June by placing fry traps over the redds. We deployed four traps in April, and added two more in May when water levels permitted additional deployments. The trap we placed over redds likely to have been constructed by pen-reared adults stocked into the Dennys the previous year. In 2001 we performed a similar study. Temperature data and embryonic developmental modeling indicated that the traps were placed when fry would have been expected to emerge. We captured fry in four traps. However, capture rates were extremely low, ranging from one to four fry per trap. In addition, we captured 43 fry in the rotary screw smolt trap (RST). Fry emerged from 24 May through 30 May in the fry traps. We captured drifting fry in the RST from 28 May through 2 June. The fry we caught in the RST were likely produced by natural spawning, but could have been the result of fry stocking in Cathance Stream or the upper Dennys. These data strongly suggest that the pen-reared salmon stocked in the Dennys River achieved poor reproductive success. Work done on the St. Croix River this year showed that the traps we used could capture large numbers of fry. However, two years of data with very low numbers of fry captured indicate poor spawning success. This is further supported by results of a controlled reproductive success study on Cathance Stream in 2000 to 2001, where very little spawning activity was documented and only one fry was captured. Electrofishing in these same areas later in the year found low densities of young-of-the-year, supporting our fry trapping findings.

e. Redd Counts

We conducted redd surveys in fall 2002 on the Dennys River. We did not count any Atlantic salmon redds. This is not unexpected because of the very low number of salmon captured at the adult weir this year.

f. Smolt Trapping

We deployed a rotary screw smolt trap (RST) in the Dennys using a novel anchoring system developed by ASC staff. Tasks involved in deploying the RST included intensive scouting of the lower Dennys River for a suitable site, rating candidate sites for flow and depth, constructing an anchoring system, and deployment of the trap. The trap operated very effectively. ASC staff tended the trap every day from 19 April to 2 June, capturing 799 smolts. Of these 692 were from smolt stocking, 83 were of wild origin, and the remaining 24 were from parr stocked the previous fall. We also operated a pair of experimental smolt traps designed by NOAA-Fisheries and built into the adult weir for a second year. The objective was to evaluate the effectiveness of the traps, as well as collect additional data on stocked and wild smolts. The traps did not perform very well despite adjustment made by NOAA-Fisheries, and caught relatively few fish. Catches for the weir-based traps were 323 stocked smolts and 3 wild smolts. However, catch efficiency was extremely dependent on water levels. The traps fished well at very high flows, but were ineffective at more moderate flows. Use of these weir-based smolts traps has been discontinued. We will continue to fish the RST on an annual basis.

2. Population Enhancement

a. Stocking

We stocked several life-history stages of salmon into the Dennys River including 52,000 smolts at two sites in Spring 2002, 94,122 fry distributed into appropriate habitat throughout the drainage in May, and 33,400 0+ parr at four sites in October.

b. Broodstock Collection

We collected 315 parr via electrofishing for transfer to the captive broodstock program at Craig Brook. All fish were weighed, measured, and sampled for scales and tissue (genetics).

3. Habitat

a. Habitat Surveys

Habitat surveys on the Dennys River are complete and no new surveys were conducted in 2002.

b. Substrate Embededness Survey

We initiated a survey of substrate embededness on the Dennys, as well as at site on other rivers. This method estimates the degree to which stream substrate has been filled in with fine sediments. High embededness (or low Interstitial Space Index "ISI") has been shown to be negatively correlated with salmonid populations, as well as other organisms such as insects. We measured embededness at 16 electrofishing sites on the Dennys. Measuring embededness at electrofishing sites will allow us to correlate embededness to fish populations. Initial calculations show an ISI mean of 2.58 with a range of 0.75 to 4.6. This is within the range reported by other researches. We will be analyzing the relationship of these embededness data to salmon populations this winter.

c. Habitat Enhancement

We did not conduct habitat enhancement in the Dennys drainage in 2001. Kleinschmidt and Associates completed an Instream Flow Incremental Methodology (IFIM) study in 2002. Using the IFIM, we have adjusted water releases at the Meddybemps dam to optimize salmon habitat and optimally manage the water budget of the system. This has resulted in an increased ability to hold water in the lake, as well as release optimal flows for Atlantic salmon. We are currently ahead of schedule for lake level and anticipate that the lake will be full by spring, allowing us to fully implement the new water management regime.

d. Property Purchases or Conservation Easements

The ASC, in cooperation with the Lands for Maine's Future Program and International Paper Company closed on a deal in late 2001 whereby IP transferred ownership of most of the riparian habitat that they owned along the Dennys River and Cathance Stream to the ASC. This will allow the ASC to ensure the integrity of the streamside habitat along the Dennys River and will provide significant benefit to all fish and wildlife, particularly Atlantic salmon.

e. Obstruction Surveys and Removal

We documented obstructions to fish passage while conducting redd counts in the fall. We did not record any fish passage problems on the main stem or lower Cathance Stream. We did not perform any obstruction removal in 2002.

ASC is cooperating with, and monitoring, a study on the effects of beaver dams and beaver dam removal on Venture Brook, a tributary of the Dennys River that historically contained salmon habitat, but became largely inundated by beaver dams. Dr. Alan Lewis and Dr. Sheri Sprangers at the University of Maine, Machias, are conducting this study. Students from the University removed four beaver dams on Venture Brook in Fall 2002. Prior to removal, and as follow-up monitoring, they took samples to estimate the load of fine sediments in the beaver impoundments, survey benthic macro invertebrate populations, and monitor water quality. This study is designed to run for several years.

e. Water Quality

The ASC recorded water temperatures with automated temperature loggers at eight sites in the Dennys drainage. We will record over-winter temperatures at all of these sites. In the summer of 2002 we recorded weekly average temperatures exceeding 25ºC at four sites. We did not record any temperatures exceeding 30ºC. We are nearing completion of populating a water temperature database with a large collection of older data, as well as contemporary data. This database will allow us to access water temperature data efficiently, perform temporal and spatial analyses, and distribute data easily.

4. Public Meetings and Outreach

The ASC staff attended meetings of the Dennys River Watershed Council, Dennys River Sportsmen Club, Downeast Rivers Coalition, Downeast Salmon Federation and Project SHARE. All of these organizations work on salmon habitat and riparian habitat issues in the Dennys River watershed. ASC staff also met with the Meddybemps Lake Association in response to concerns over low lake levels in 2001. ASC staff also met with selectmen and planning board members in the Town of Dennysville to work out arrangements that will permit ASC to take title to lands currently owned by IP within town limits.

Ducktrap River

The Ducktrap River is located in Waldo County. It flows approximately 17 km from its source at Tilden Pond to its confluence with the lower Penobscot River estuary at Ducktrap Harbor in Lincolnville. Kendall Brook, Tucker Brook, and Black Brook are the only major tributaries. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (USFWS) listed the Atlantic salmon population in the Ducktrap River as endangered on November 13, 2000. ASC conducted the following enhancement and management activities on the Ducktrap during calendar year 2002.

Activities

1. Population Monitoring

a. Electrofishing

The two index sites on the Ducktrap River were sampled during early October. Due to the extremely low flows, we held off on our juvenile salmon assessments until higher water levels and cooler temperatures ensured reasonable sampling conditions. No young-of-year (YOY) salmon were found but a few parr were captured. Biological data (lengths, weights, scale samples for age determination, genetics) was collected from nine salmon parr sampled at two index sites.

b. Redd Counts

There were three attempts to document spawning in the Ducktrap River (November 4, November 14, November 21) in the fall of 2002. On November 14, brook trout were seen digging redds below the Rte. 52 Bridge. However, no salmon were observed. Summer long low flows in the Ducktrap likely limited access of adult salmon to upriver spawning grounds. On October 17, fall rains began at which time water levels rose to allow the migration of adult salmon into the Ducktrap.

2. Habitat

a. Property Purchases or Conservation Easements

The Coastal Mountains Land Trust (CMLT) and Ducktrap Coalition completed three riparian land protection projects during 2002. A total of 81% of the land along the river and 46% of the lands along Tucker Brook, Black Brook, and Kendall Brook are now in conservation easements. The groups also rehabilitated three non-point source pollution locations. One site was rehabilitated through a 319-grant from the Maine Department of Environmental Protection. The site had been a source of sediment impacting a highly productive spawning area. Two sites which were forest harvesting related were rehabilitated through an USDA EQIP grant.

b. Obstruction Surveys and Removal

We recorded a number of fish passage problems on the main stem below and above the Rte. 52 Bridge. Extremely low flows throughout the early fall season compounded the effect of

obstructions. Two beaver dams were breached on two occasions below Rte. 52 to provide some moving water through the lower river. Two other beaver dams were breached on three occasions. These higher flows were documented at the USGS gauging station at the Rte. 52 road crossing. During these burst of flows and fall rains, passage was no longer impeded. Prior to fall rains, small amounts of debris were removed to provide flow through this reach on two occasions. The Ducktrap Coalition and ASC staff worked together to remove larger debris obstructions below Rte. 52.

c. Water Quality

ASC staff recorded summer water temperature on the Ducktrap River at two sites: below the Rte. 52 and the Mill Road bridges. The MDEP also collected water quality data from the Ducktrap. In addition to the summer collection of water temperature data, the ASC will also collect temperature data at one location throughout the winter months. All data will be analyzed during the winter and spring of 2002 – 2003 and will be available in late spring by contacting the ASC.

3. Meetings

The ASC staff attended several meetings of the Ducktrap Coalition.

East Machias River

The East Machias River is located in Washington County. Originating at Pocomoonshine Lake, it flows approximately 59 km to its confluence with the Machias Bay in the town of East Machias. Beaverdam Stream, Northern Stream, Seavey Stream and Chase Mill Stream are significant tributaries in the drainage. The Atlantic salmon population was listed as endangered by the National Marine Fisheries Service (NOAA-Fisheries) and the U. S. Fish and Wildlife Service (USFWS) on November 13, 2000. The Atlantic Salmon Commission (ASC), in an effort to restore the salmon, conducted the following enhancement and management activities in calendar year 2002.

Activities

1. Population Monitoring

a. Adult Weir Operations

The ASC obtained State and Federal permits to install a salmon weir on the main stem of the East Machias River at the Gaddis pool site, just upstream of the Route 1 Bridge. Local permitting issues have delayed installation of the weir. In order to mitigate these issues alternative sites have been chosen and are undergoing site surveys and equipment designs. One site is located on the main stem East Machias at the Route 191 crossing. The other site is located within Chase Mill Stream a tributary that enters the river below the Route 191 crossing. A report on alternative sites prepared for Governor King is available on request. Both sites are necessary to ensure aquaculture escapees are excluded from spawning areas in the watershed.

b. Electrofishing

We conducted electrofishing surveys at nine sites within the East Machias drainage in 2002. Of these, eight were multiple-pass depletion population estimates, and one was a broodstock collection. Median density of parr in 2002 was 4.21 parr/unit and median density of young-of-the-year (YOY) was 5.54 YOY/unit. This is lower than in 2001 when median parr density was 8.33 parr/unit and median YOY density was 32.90 YOY/unit.

c. Telemetry

No active or passive telemetry was undertaken during 2002.

d. Redd Counts

We conducted one redd survey of the East Machias covering a majority of the available spawning habitat. We counted 5 redds, all located downstream from Round Lake. Although high water and poor visibility made these surveys difficult, and we have been unable to visit one high quality spawning area, this number of redds is extremely low.

2. Population Enhancement

a. Stocking

We stocked approximately 236,868 fry into appropriate habitat throughout the drainage in May. No smolts or pen-reared adults were stocked in the East Machias River this year.

b. Broodstock Collection

We collected 174 parr for use as captive broodstock. These fish were transported to Craig Brook National Fish Hatchery.

3. Habitat

a. Habitat Surveys

No new habitat surveys were conducted within the East Machias watershed. Data collected in 2001 is nearing final editing and will soon be available in Geographic Information System format.

b. Embededness Survey

We initiated a survey of substrate embededness on the Downeast salmon rivers in 2002. This method estimates the degree to which stream substrate has been filled in with fine sediments. High embededness (or low Interstitial Space Index "ISI") has been shown to be negatively correlated with salmonid populations, as well as other organisms such as insects. We measured embededness at six sites, including the Munson bridge replacement site before bridge construction was begun (see # 4 below). This will provide a baseline for subsequent embededness work to monitor effects of the new bridge. Mean ISI was 2.03 and ranged from 1.85 to 3.7. This is within the range reported by other researchers.

c. Habitat Enhancement

We did not conduct habitat enhancement in the East Machias drainage in 2002; however, the East Machias Watershed Council and Project SHARE conducted some on site projects (see #4 below).

d. Obstruction Surveys and Removal

We documented obstructions to fish passage during other fieldwork. We did not record any fish passage problems on the main stem, but we breached seven beaver dams on Northern Stream prior to spawning season.

d. Water Quality

The ASC recorded water temperatures with automated temperature loggers at nine sites in the East Machias drainage. We will continue to monitor temperatures at these sites through the winter. In the summer of 2002 we recorded weekly average temperatures exceeding 25ºC at two sites and we recorded peak temperatures exceeding 30ºC at three sites. We are nearing completion of populating a water temperature database with a large collection of older data, as well as contemporary data. This database will allow us to access water temperature data efficiently, perform temporal and spatial analyses, and distribute data easily.

4. Public Meetings and Outreach

ASC staff attended meetings of the East Machias River Watershed Council, Downeast Rivers Coalition, Downeast Salmon Federation and Project SHARE. All of these organizations work on salmon habitat and riparian habitat issues in the East Machias River watershed. The Two Rivers Watershed Councils (East Machias and Machias) completed a project at Munson rips to prevent motorized vehicles from fording the river. They installed a single-span bridge for ATVs and snowmobiles at a site where an old bridge previously existed. The piers from the old bridge were removed and placed along the riverbank to prevent larger vehicles from fording the river. ASC staff recorded redds in this area during annual spawning surveys this Fall. Staff attended East Machias town Planning Board meetings pursuant to local requirements that a town building permit is necessary for the ASC to construct a salmon weir within Town jurisdiction. ASC staff has also worked with members of the East Machias Planning Board and Selectmen to locate alternative weir sites.

Kenduskeag Stream

Kenduskeag Stream drains an area of 214 square miles west of Bangor and is the largest lower Penobscot River tributary. Salmon have been found in many of the cool tributaries above Kenduskeag Village in recent years. These tributaries include French Stream, Black Stream, Pierre Paul Brook, Allen Stream, and Crooked Brook. The ASC, in cooperation with the USFWS, NMFS, MDIFW, PIN, USDA, and additional stakeholders, conducted the following enhancement and management activities in calendar year 2002.

Activities

1. Population Monitoring

a. Electrofishing

The juvenile salmon population on Kenduskeag Stream was surveyed via electrofishing at 86 locations during July and August to determine presence or absence of salmon within the entire main stem of the stream. The stream was sampled from North to South working through the highest productivity areas while the water levels were average and prior to water temperatures rising to stressful limits for juvenile salmon. To start our sampling, we chose an area that had not been sampled the previous year to establish the presence or absence of salmon within this reach of the drainage. Sixty-nine parr were sampled in the area north of Corinth. These fish were sampled from areas of high productivity, cool water, and good, natural, undisturbed habitat. Biological data (length, weight, scale samples to determine age and origin, genetics) was taken from each fish. Scale data will be analyzed in early 2003 and information will be available from the ASC in early spring. Genetic material has been turned over to the USFWS for analysis in 2003.

b. Redd Counts

Five redd counts were conducted on the main stem (Oct. 31, Nov. 7, 12, 26, 27), each covering only portions of the spawning habitat; in part because of the extensive drainage area of the river and time constraints it took to cover large areas of habitat. All areas were sampled at least twice and areas of highest interest were checked three times. No sign of adult spawning was observed throughout the drainage during the fall of 2002.

2. Habitat

a. Water Quality

Water temperature data were collected with thermograph units at nine sites. Thermographs were placed throughout the drainage starting at the northern most site: Millet Road approximately 2.5 miles below Garland Pond in Garland; Fernald Road (the area in which all the salmon parr were found); the confluence of French and Allen Stream; Beans Mills Road crossing (the start of heavy agriculture use); Corinth Road crossing; Covered Bridge; Kenduskeag Village; the end of Ohio Street in Glenburn; and Six Mile Falls. These sites were chosen in an attempt to gain a complete river temperature profile and to also identify areas of potential concern for high summer water temperatures. The upper river at Kenduskeag Village is small and has greater canopy cover and spring water influences than

the lower river. The lower Kenduskeag is wider and more exposed, allowing for significant daily fluctuations in temperatures. The lower river also has a greater agricultural use. Temperature data will be analyzed during winter 2002-2003 and will be available in late spring by contacting the ASC.

b. Obstruction Survey and Removal

During October 2002, obstructions such as beaver dams or woody debris were located and either removed or breached to encourage salmon migration. We concentrated our efforts in the area above Corinth due to the fact we had found a number of salmon parr in this area. Numerous beaver dams were breached within this three-mile area. Other beaver dams in the lower river were breached on fewer occasions to permit salmon migration or a surge of water to stimulate migration.

c. Habitat Survey

The Maine Fishery Resources Office, U.S. Fish and Wildlife Service (USFWS), in cooperation with the Gulf of Maine Project Office (also USFWS) and Maine Atlantic Salmon Commission, conducted a habitat survey of Kenduskeag Stream in 2002. Approximately 31 river miles were surveyed over a two-month period from the outlet of Garland Pond to Six Mile Falls. The data indicates that there are 571 units of riffle and run habitat within the drainage (one unit equals 100 square meters of suitable habitat). Of this total, 442 units were surveyed above the confluence of French and Allen streams. This area is potentially the most productive and retains the greatest amount of cool water throughout the summer. Part of this area is also the area where parr were found during our electrofishing survey. The remaining 129 units of habitat are below the French and Allen stream confluence and holds little to no value for Atlantic salmon productivity, although this area would be used as a migratory corridor.

d. Habitat Protection

A restoration project supported by NRCS, USFWS, NMFS, and ASC, at the old Bacon Mill site, has been in the planning stages since last year. It is anticipated that project work will take place over the summer of 2003. Jed Wright (USFWS) and John Parrish (Contractor) have completed a geomorphic assessment that will guide the stream channel restoration. Monies have been pledged to replace a 25-foot bridge crossing with a larger 65-foot bridge help restore the stream channel. The Engineering Department at the University of Maine, Orono, is designing the bridge. To date, $38,500 has been raised to replace the bridge: $25,000 from the Fish America Foundation and $12,500 from the Town of Exeter. An additional $25,000 is needed to finish this part of the project. It should also be noted that the town of Exeter has agreed to cooperate on the removal of a dam on French Mill Stream pending landowner permission. A total of $20,000 has been raised for its removal in the event that landowner permission is obtained.

Kennebec River

The Kennebec River is located in Somerset, Piscataquis, Kennebec, and Sagadahoc counties. It flows 222 kilometers (km) from its source at Moosehead Lake to the head of Merrymeeting Bay. Encompassed in its 15, square km basin, the Kennebec River has eight major tributaries along with numerous small streams. The river currently has a small population of Atlantic salmon confined to the portion of the river and its tributaries below the first impassable dam in Waterville. The Atlantic Salmon Commission (ASC) conducted the following activities in the year 2002 in an effort to document Atlantic salmon activities.

Activities

1. Population Monitoring

a. Electofishing

We electrofished six sites in three tributaries; Bond Brook, Togus Stream and Sandy River and one site in the main stem of the Kennebec River in Sidney. All sites were evaluated using a single pass measured method except one site in Sandy River where a three-pass depletion method was used. A copy of this data can be obtained by contacting the ASC.

b. Redd Counts

The main stem of the Kennebec River was not surveyed due to high water conditions. We did, however, complete one survey of Bond Brook, Togus Stream, Sevenmile Stream and Messalonskee Stream between November 13 and December 5. No redds were found.

2. Habitat

a. Habitat Surveys

The ASC conducted Atlantic salmon habitat surveys in tributaries of the Kennebec River to determine the amount of potential habitat that exists for adult spawning and juvenile rearing in the basin. Habitat in Twentyfive Mile Stream was completely surveyed whereas partial surveys on the Sandy and Sebasticook rivers were conducted. The surveys encompassed approximately 36 miles of riverine habitat.

b. Temperature Monitoring

Sixteen data loggers were deployed in Outlet Stream, Martin Stream (Fairfield), Sandy River and the Kennebec River in Madison, Skowhegan, and Fairfield to record summer river temperatures. A copy of this data can be obtained by contacting the ASC.

3. Meetings

a. Hydro Re-licensing

ASC staff attended numerous meetings and field events associated with the hydro re-licensing of Abenaki and Anson (Madison Paper Industries), Lockwood (Florida Power and Light), Sandy River (Town of Madison), and Fort Halifax (Florida Power and Light)

Projects. Additionally, ASC staff spent considerable time analyzing and commenting on Maine Department of Transportation projects within the watershed.

b. Presentations

ASC staff presented a poster at the alewife festival held by the Kennebec Chapter of Trout Unlimited in Winslow.

c. Workshops

ASC staff attended workshops associated with habitat conservation and enhancement. We attended the 13th International Salmonid Enhancement Workshop and two Fluvial Geomorphology workshops.

d. Biological Assemblage Project

We attended meetings and supplied comments to Kleinschmidt Associates regarding a biological assemblage project (Index of Biological Integrity) conducted between Bingham and Merrymeeting Bay on the Kennebec River.

Machias River

The Machias River is located in Washington and Hancock Counties. The river originates in Fifth Machias Lake and flows approximately 98 km to its confluence with Machias Bay in Machias. Major tributaries include Old Stream, Mopang Stream, and the West Branch Machias River. The Atlantic salmon population was listed as endangered by the National Marine Fisheries Service (NOAA-Fisheries) and the U. S. Fish and Wildlife Service (USFWS) on November 13, 2000. The Atlantic Salmon Commission (ASC) conducted the following enhancement and management activities on the Machias River in calendar year 2002.

1. Population Monitoring

a. Adult Weir Operations

There is currently no adult trapping facility on the Machias. Planned construction of a counting and sorting weir and fish trap on the Machias River has been delayed. The adult population is primarily monitored via redd counts.

b. Electrofishing

We electrofished 23 sites in the Machias drainage in 2002, eleven were multiple-pass depletion population estimates, and the remaining twelve were one-run captures for broodstock collections. Median density of parr was 3.35 parr/unit and median density of young-of-the-year (YOY) was 3.80 YOY/unit. This indicates a slight drop in the density of parr from 2001 and a more substantial decrease in YOY.

c. Redd Counts

We conducted redd counts in most of the spawning habitat in the Machias drainage and counted only three redds. This is an extremely low count. High water and poor visibility made counting difficult at times. Most of the known quality spawning areas did not have redds.

2. Population Enhancement

a. Stocking

We stocked 360,621 fry into appropriate habitat throughout the drainage.

b. Broodstock Collection

We collected approximately 272 parr via electrofishing for transfer to the captive broodstock program at Craig Brook National Fish Hatchery (CBNFH). All fish were PIT tagged, tissue sampled (genetics), and more than 100 were weighed, measured, and sampled for scales.

3. Habitat

a. Habitat Surveys

The major waters of the Machias drainage have previously been completed and no new surveys were conducted in 2002.

b. Habitat Preservation and Protection

The ASC has joined with The Nature Conservancy, the Department of Conservation, and International Paper to develop a permanent conservation easement along most of the main stem of the Machias River and several of its important tributaries. Negotiations are still underway and details not available at this writing.

c. Substrate Embededness Survey

We initiated a survey of substrate embededness on the Downeast salmon rivers in 2002. This method estimates the degree to which stream substrate has been filled in with fine sediments. High embededness (or low Interstitial Space Index "ISI") has been shown to be negatively correlated with salmonid populations, as well as other organisms such as insects. We measured embededness at two sites on Old Stream, the most productive tributary in the Machias drainage. The ISI ranged from 1.81 to 2.26. This is within the range reported by other researchers.

c. Obstruction Surveys and Removal

Obstruction removal was limited to Old Stream and the Crooked River where we breached 41 beaver dams on Old Stream and one on the Crooked River. No other obstruction removal efforts were made in the year 2002. Obstructions to fish passage throughout the drainage were documented during redd surveys in the fall. We recorded only one fish passage problem on the main stem located at the inlet to Second Machias Lake. A large beaver dam that was probably built during the drought in 2001 caused this problem.

d. Water Quality

The ASC recorded water temperatures with automated temperature loggers at fourteen sites in the Machias drainage. We will record water temperatures at all of these sites through the winter. In the summer of 2002 we recorded weekly average temperatures exceeding 25ºC at three sites and we recorded peak temperatures exceeding 30ºC at two sites. We are nearing completion of populating a water temperature database with a large collection of older data, as well as contemporary data. This database will allow us to access water temperature data efficiently, perform temporal and spatial analyses, and distribute data easily.

4. Public Meetings and Outreach

The ASC staff attended meetings of the Machias River Watershed Council, Downeast Watershed Coalition, Downeast Salmon Federation, and Project SHARE. All of these organizations work on salmon habitat and riparian habitat issues in the Machias River watershed.

Marsh Stream

Marsh Stream is located in Waldo County. It flows approximately 48 km from its source at Upper Drake Pond to its confluence with the South Branch of Marsh Stream in Frankfort. The North Branch has only one major tributary, also named South Branch, which empties into the main stem just upstream of the West Winterport Dam. There are a number of smaller tributaries as well as intermittent streams. The North Branch of Marsh Stream has two small hydro dams located in the towns of Frankfort and West Winterport. The South Branch of Marsh Stream has three tributaries: Colson Stream, Hawes Stream and Carley Brook. The Atlantic Salmon Commission (ASC) conducted the following enhancement and management activities on Marsh Stream in calendar year 2002.

Activities

1. Population Monitoring

a. Electrofishing

Nine electrofishing sites were sampled within the Marsh Stream drainage. Eight sites were sampled in August and one in September, all during low water levels. Brief one-run surveys were used to cover large expanses of habitat to determine the presence or absence of juvenile salmon. Since no yoy or parr were found in the North Branch in 2001, only areas with spawning and riffle habitat were sampled in 2002. The South Branch of Marsh Stream (Colson Stream, Hawes Stream) was sampled and only a few hold over salmon from 2001 were found. Smallmouth bass were found throughout the entire North Branch drainage except where largemouth bass occupied the habitat. Largemouth bass were found in the river reach between Upper and Lower Drake Ponds. Biological data was collected and will be analyzed during winter 2002-2003 and information will be available from the ASC in early spring.

b. Redd Counts

There were two attempts to find redds on Marsh Stream (November 5, November 25) but none was found on either occasion.

2. Habitat

a. Water Quality

The Salmon Commission recorded summer water temperature on Marsh Stream at five sites: above the Railroad Trestle, below West Winterport Dam, below the Monroe Center Falls, Monroe Village, and Crane Bridge. Additionally, water temperature data will be taken by the ASC at two locations over the winter. All data will be analyzed during the winter months of 2002-2003 and information will be available from the ASC in early spring.

3. Meetings

The ASC staff attended meetings in regard to the permitting process for the removal of the West Winterport Dam as well as correspondence with the dam owner and members of F.I.S.H.

(The following Marsh Stream report was inadvertently omitted from the ASC 2001 Annual Report)

Marsh Stream

Activities

1. Population Monitoring

b. Electrofishing

Numerous electrofishing sites were sampled on Marsh Stream. Ten sites were sampled early in August during extreme low water levels. Extensive one-run surveys were used to cover large areas of habitat in search of salmon parr and young-of-year (YOY). There was no YOY salmon or parr found. Small mouth bass were found throughout the entire drainage except where largemouth bass occupied the habitat. Largemouth bass were found in two areas: in the river reach between Upper and Lower Drake Ponds as well as in the impoundment above the West Winterport Dam. Electrofishing data will be analyzed during winter 2001-2002.

b. Redd Counts

There were two attempts to find redds on Marsh Stream in 2001 (November 5, November 19) none was found on either occasion.

2. Habitat

b. Habitat Survey

During the months of June and July, ASC staff surveyed the main stem of Marsh Stream. The survey was undertaken to update existing information and to obtain the amount of quality habitat throughout the drainage for estimation of the production capability of the watershed. The habitat data collected is currently being analyzed by the USFWS, Gulf of Maine Project Office, in Falmouth, Maine. The USFWS will produce an Atlantic salmon habitat map for Marsh Stream.

c. Obstruction Surveys and Removal

The two small hydro dams on Marsh Stream both have fish ways. The fish way in Frankfort operated for most of the summer but due to the extreme low water caused by the 100-year drought in the Northeast, the fish way did not always have enough water to provide passage during the summer months, limiting all access to the stream from July to the November. The dam in West Winterport is in the process of being decommissioned and upstream passage was unavailable for most of the summer. Beaver dams located above the town of Monroe were breached on two occasions to provide an increase in flow downstream.

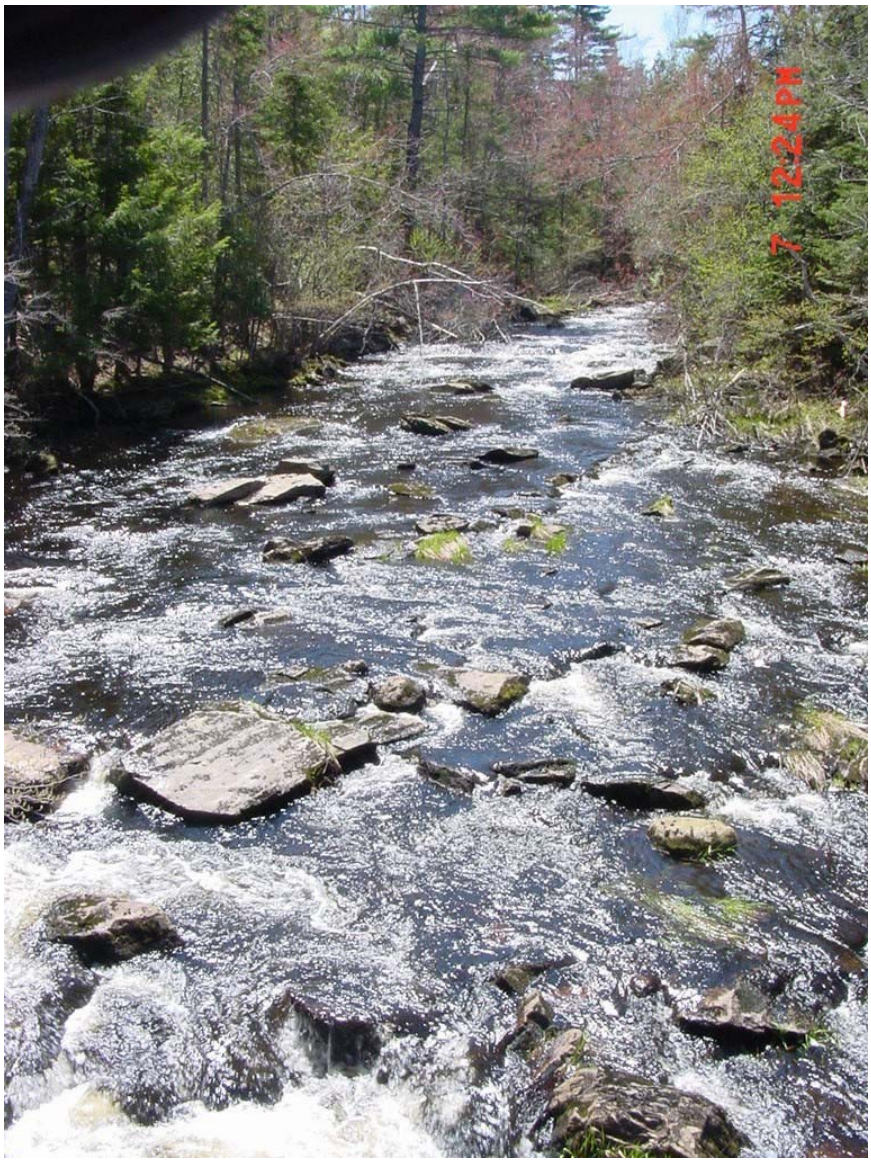
d. Water Quality

The Salmon Commission recorded summer water temperature on Marsh Stream at four sites: above the Rail Road Trestle, above and below West Winterport Dam, and below the falls in a tributary, the South Branch. The MDEP also collected data from Marsh Stream.

Additionally, water temperature data will be taken by the ASC at one location over the winter. All data will be analyzed during the winter months of 2001 and 2002.

3. Meetings

The ASC staff attended public meetings in regard to the permitting process for the removal of the West Winterport Dam.



Narraguagus River

The Narraguagus River is located in Washington and Hancock Counties. From its source at Eagle Lake in TWP 34MD, it flows approximately 78 km to tidal waters in Cherryfield and from there into Narraguagus Bay in Milbridge. The West Branch Narraguagus is its principal tributary. The Atlantic Salmon Commission (ASC), in an effort to recover the Federally Endangered salmon population in this river, conducted the following enhancement and management activities in calendar year 2002.

Activities

1. Population Monitoring

a. Adult Trap Operations

We operated a fishway trap at the Cherryfield ice control dam from 2 May through 4 November to trap upstream migrating adults to monitor the wild adult run and to intercept any escaped aquaculture fish that may enter the river. We captured 8 naturally produced sea-run salmon. We captured no salmon suspected to be aquaculture escapees in the Narraguagus River in 2002. This year's trap catch represents a decrease of 22 salmon from the 2001 catch of 30 sea-run salmon.

b. Electrofishing

We electrofished 44 sites in the Narraguagus drainage, and we obtained multiple-pass population estimates at 32 sites. Parr were present at all but one site, which we sampled juvenile salmon with a single pass. Biological data were obtained for age and origin determination as well as tissue samples for genetics analysis by the USGS. These data have been entered into an electronic database, which is presently being audited for accuracy. These data are used to estimate juvenile salmon abundance on a drainage-wide basis. Eight additional sites were sampled with a single pass to collect parr for Craig Brook National Fish Hatchery's captive broodstock program. We are also studying the relation between habitat area and river flow at our sampling sites, in order to improve the accuracy of our population assessments.

c. Redd Counts

We conducted redd counts on the Narraguagus River main stem and two of its tributaries. The West Branch Narraguagus contains relatively little spawning habitat and is logistically impractical for redd counts. We counted 6 redds on the main stem. This count is consistent with expectations based on the capture of three maturing female salmon at the Cherryfield trap in 2002. Three redds were located in the river reach between Beddington Lake and Rte. 193 (~35 km upstream of tidal waters) and 3 redds just upstream of Route 9 (at approx. 50 km upstream of tidal waters). No redds were observed in the two tributaries surveyed (Baker Brook and Gould Brook). This year's count is smaller than observed in 2000 (21 redds) and 2001 (24 redds), and represents only about 1% of what is needed to assure full juvenile habitat utilization.

2. Population Enhancement

a. Stocking

We assisted in the distribution of approximately 274,000 fry into the Narraguagus River in 2002. These fish were the offspring of wild parr collected as brood fish from the Narraguagus in previous years and reared to maturity at Craig Brook National Fish Hatchery by the U.S. Fish and Wildlife Service. They were distributed throughout the drainage in a manner designed to minimize interactions with naturally produced fry during their first year in the river. Most of these fry were reared at Craig Brook National Fish Hatchery, but approximately 44,000 Narraguagus River eggs were transferred to the Pleasant River Hatchery in Columbia Falls for rearing in winter 2002. Local volunteers and students distributed the 44,000 fry from that facility into the Narraguagus River and tributaries in May 2002.

b. Broodstock Collection

We collected 260 age-1 and age-2 parr via electrofishing and transported them to Craig Brook National Fish Hatchery for use in their captive broodstock program. We weighed and measured all fish, and collected scale and tissue samples for genetics monitoring.

3. Habitat

The Narraguagus River main stem habitat survey was completed in the mid 1990's and no new surveys were done in 2002.

a. Obstruction Surveys and Removal

While doing electrofishing surveys, we document obstructions to fish passage. A number of beaver dams and debris jams were noted, and we manually breached several dams in the lower main stem deemed obstacles to migration in late October and early November, prior to spawning by returning Atlantic salmon. The beavers typically repair dam breaches within a few days of occurrence, but salmon obstructed by the dam can pass upstream during the temporary 'freshet' caused by the dam breach.

b. Water Quality

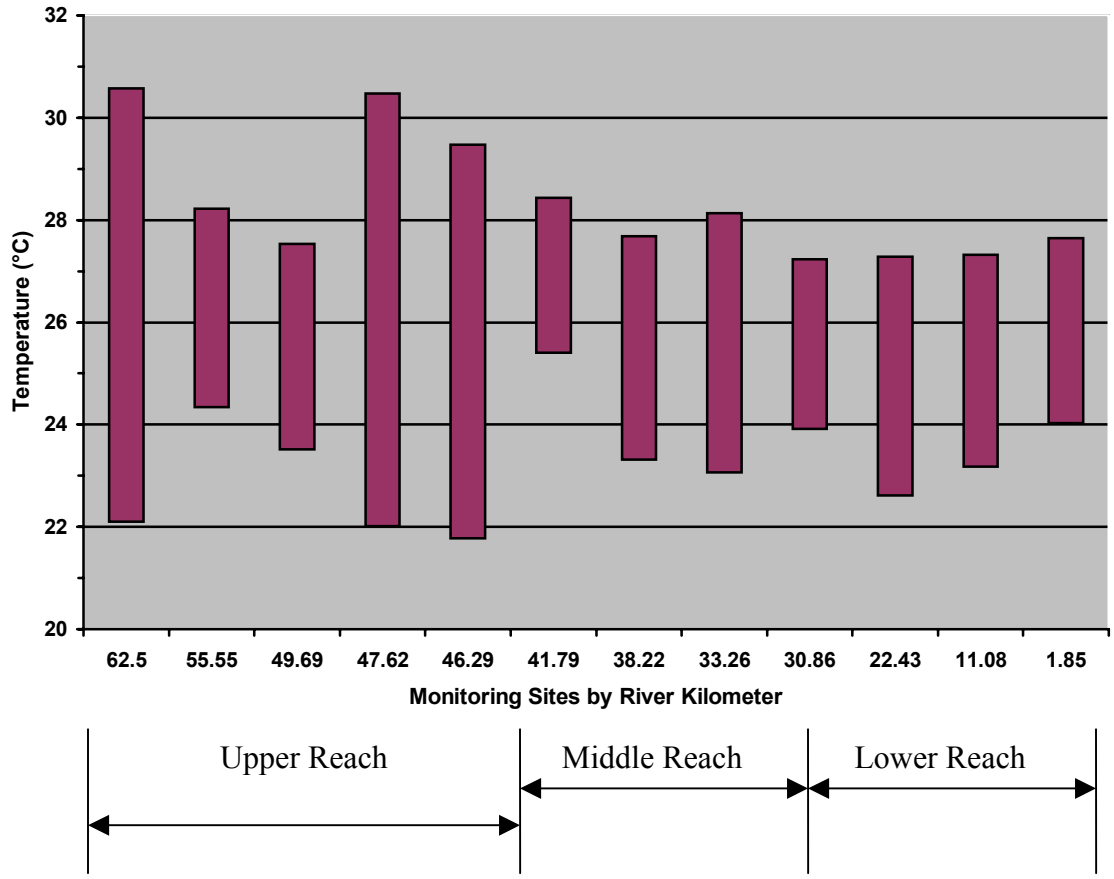
The ASC recorded summer water temperature at 11 sites on the main stem of the Narraguagus River and at one site on the West Branch Narraguagus River. Our objectives for monitoring temperature are: to evaluate the potential limiting effects of provide water temperature on growth and survival of juvenile Atlantic salmon; to investigate water temperature at the reach level and possibly identify sections of river more susceptible to critical water temperatures; to continue to build upon a historical temperature database used it to investigate temporal changes for the Narraguagus River.

Based on data from the Deblois temperature monitoring index site (river km 33.26), 2002 was the 3rd warmest summer on record in the 1991-2002 time series, behind only 1999 and 2001 respectively. Although the time series is relatively short, this is evidence for recent warming that may be part of a natural cycle or long term trend. Overall, 2002 had the 6th highest recorded maximum temperature (28.1^{o}C), the 2nd highest total number of days with a

temperature greater than 27°C, and the 2nd highest number of days in which the temperature did not go below 22.5°C for this time period. Optimal growth of juvenile salmon occurs when water temperature is between 15 and 19°C with normal feeding patterns being disrupted when temperatures exceed 22.5°C.

The river was divided into three reaches based upon major geomorphic and related salmon rearing habitat breaks; Upper Reach (river km > 45.94); Middle Reach (river km 41.81 – 30.86); Lower Reach (river km 31.63 – 1.85). In 2002 the Upper Reach was more likely to have acute lethal temperatures than the lower reaches, particularly the areas above and around the 31-00-0 Road monitoring site (km 62.50), and from the Hemlock Dam site to Beddington Lake (river km 49.69 - 45.94). The middle and lower reaches tended to be 2-3 degrees cooler on extremely hot days. All three reaches had thermal regimes (Figure 1) that exposed salmon to temperature greater than 22°C that may lead to juvenile salmon mortality from starvation, and increased susceptibility to predation and disease.

Figure 1. Daily range of temperatures recorded August 15, 2002 at 12 different monitoring sites in the Narraguagus River, Maine



Passagassawakeag River

The Passagassawakeag River is located the Towns of Waldo, Belfast, Morrill, Brooks, and Knox in Waldo County. It flows approximately 25 km from its source at Lake Passagassawakeag (Brooks) to its confluence with the Penobscot River estuary at Belfast Bay in Belfast. Wescott Stream is its only major tributary. ASC conducted the following assessment activity during calendar year 2002.

Activities

1. Population Monitoring

a. Electrofishing

Two electrofishing sites were sampled for juvenile salmon in 2002. The site at head of tide, the Doak Farm site, was sampled again this year for yoy and parr. Parr were found in low numbers, presumably holdovers from the previous year. A second site sampled, Rte. 137 bridge crossing, is located upstream about 1.6 miles of the Doak Farm site. No salmon were found at Rte. 137. Biological data was collected from each fish and will be analyzed over the winter of 2002-2003; information will be available from the ASC in early spring.

b. Redd Counts

Two attempts were made to search for redds in areas of the lower Passagassawakeag River where spawning activity had been observed in previous years. No salmon digging activity was seen on November 5 or on November 21 in the lower Passagassawakeag River near the Doak Farm in Belfast.

2. Habitat

a. Water Quality

ASC recorded summer water temperature on the Passagassawakeag River at two sites: Iron Bridge and Doak Farm. ASC staff will collect temperature data at one location throughout winter months in addition to the summer collection of water temperature data. All data will be analyzed during winter and spring 2002 – 2003 and information will be available from the ASC in early spring.

Penobscot River

The Penobscot River drains an area of 8,570 square miles, spans seven counties, and is Maine's largest river system. Annual runs of 40,000 to 75,000 Atlantic salmon were possible prior to the 1800's but the current production potential for the river has declined to an estimated 4,000 to 11,000 adult fish due to habitat alteration and loss. Major tributaries to the Penobscot River include the East and West branches, Piscataquis, Passadumkeag, and Mattawamkeag Rivers. In addition, four significant tributaries enter the tidal portion of the Penobscot River: Kenduskeag Stream, Souadabscook Stream, Cove Brook, and Marsh Stream. The National Marine Fisheries Service (NMFS) and the U. S. Fish and Wildlife Service (USFWS) listed the Atlantic salmon population of Cove Brook as endangered on November 13, 2000. The ASC, in cooperation with the USFWS, NMFS, MDIFW, PIN, USDA, and additional stakeholders, conducted the following enhancement and management activities in 2002.

Activities

1. Population Monitoring

a. Adult Trap Operations

Veazie Dam. We operated a fishway trap at the Veazie hydroelectric dam from May 13 through November 1 to capture upstream migrating adult Atlantic salmon. We measured and recorded biological data from returning salmon and retained a portion of the run for hatchery broodstock. We captured a total of 780 adult salmon in 2002, a decrease of 6 fish from the 2001 catch and the second lowest trap catch on record. We collected scale samples from 616 salmon to estimate the age and origin structure of the run, and obtained non-lethal tissue samples from 772 fish for DNA analysis. Of the 780 adults returning to the trap in 2002, 378 (48.5%) were 1 sea-winter (1SW) age-class fish. This is the highest observed percentage of 1SW fish for any year in the 1987-2002 time series and is approximately double the 15-year mean (24.8%). The observed increase in the 1SW component of the 2002 run may reflect improved survival of the 2001 smolt cohort, or a shift in the age structure of the salmon population. Only 4.2% of the 1SW fish were of wild (non-hatchery smolt) origin compared with 11.1% of the MSW fish. We captured four salmon suspected to be aquaculture escapees in the Penobscot River, and disposed of them in accordance with ASC policy. Of the 402 fish (MSW salmon and grilse) passed above Veazie in 2002, only 30 were females. This represents approximately 1% of the spawning escapement required to meet the conservation target set for the Penobscot drainage.

Weldon Dam. The Great Lakes Hydro America, LLC (GLHA) (aka -Great Northern Paper Company) continued operation of an Atlantic salmon trap at the fishway of their Weldon dam. The dam is located 60 miles upstream from Bangor and is the fifth and final main stem dam encountered by salmon on their upstream migration. The trap was operated daily from June 10 to October 31, 2002. The 2002 trap catch (99 salmon) was eighty per cent higher than last year's catch (20 salmon). The 1SW component showed the largest increase (76 vs. 13) but the number of the large MSW fish also improved from 7 to 23 fish.

All trapped fish were counted and permitted to swim from the trap without additional handling to minimize stress. Downstream fish passage studies were not attempted in 2002 due to on-site logistical problems, but will resume in 2003.

b. Electrofishing

Juvenile population assessments were conducted on Wassataquoik Stream (two sites), the upper Piscataquis River (two sites), and the West Branch of the Pleasant River (one site). These sites were surveyed in conjunction with an ongoing effort to evaluate fry stocking practices. Juvenile salmon YOY (young-of the-year) densities as high as 16.55 $100m^{-2}$ were observed. Estimates of parr production were hampered by the occurrence of recently stocked parr that had dispersed rapidly upstream into sampling areas. The process of organizing and entering archival Penobscot River electrofishing data in to a new Access database was continued in 2002.

c. Redd Counts

Annual redd count surveys are not usually conducted in the Penobscot watershed upstream of the Veazie dam due to the reliability of population data collected at the Veazie fishway trap, the relatively low spawning escapement, and the physical difficulties in obtaining an accurate estimate on such a large river. Based on data from a salmon migration study (see PIT tag study below) a spawning survey of the Pleasant River was conducted and six redds were located in or near the East Branch of the Pleasant River. No redds were observed in surveys of the lower Piscataquis.

2. Population Enhancement

a. Stocking

Fry were stocked into select reaches of the East Branch, Piscataquis, and Pleasant tributaries in May of 2002. All 860,000 fry released were "genetically tagged", a technique first implemented in 2000, which should significantly increase the opportunity to evaluate and improve stocking practices. A total of 547,000 smolts were stocked, including those targeted for research projects regarding migratory behavior and experimental smolt release ponds. A total of 399,000 parr was released in the spring and fall into the main stem Penobscot, Mattawamkeag, Piscataquis, and Pleasant Rivers as a stock enhancement measure. All parr were marked and distributed in manner that would minimize conflict with other management or research activities.

b. Broodstock Collection

Broodstock collection goals for 2002 were not met due to low numbers of returning adult salmon and the release of some potential broodstock for an "in-river" PIT tag research project. We did collect sufficient broodstock (377 fish) to maintain full smolt production and provide some fry production. All adult broodstock collected from the Penobscot River were marked with individually coded PIT tags, either at time of capture, or when sampled for diseases once at Craig Brook NFH. All of the 124 broodstock screened for ISAV (infectious salmon anemia virus) were negative. Despite the additional handling stress resulting from the disease sampling, pre-spawning mortalities among 2002 broodstock at Craig Brook NFH remained low (<1.5%). There were no trapping related salmon mortalities at Veazie in 2002.

3. Habitat

a. Habitat Surveys

New habitat survey methodology developed and implemented in 2001, was further refined in 2002, increasing survey efficiency while maintaining the level of detail required for effective salmon management. Over 38 miles of Penobscot River tributaries were surveyed and mapped in 2002 to assess salmon habitat quantity and quality. A survey of the lower 11 miles of Wassataquiok Stream confirmed that the area is uniformly high quality rearing habitat. A remote 21-mile long reach of the Big Seboeis River from the Matagamon Road Bridge to its confluence with the East Branch Penobscot was surveyed in 2002. Numerous small islands, low gradient rapids, and abundant spawning habitat characterize this river. Smallmouth bass, a non-native predator of Atlantic salmon, were widespread in the Big Seboeis River. The East Branch Pleasant River was surveyed from the outlet of Ebeemee Lake to its confluence with the West Branch at Brownville Junction. This 5-mile long reach has high gradient riffles and excellent rearing habitat in upper sections, with lower gradient riffles and spawning gravel in lower sections. These habitat data were used in conjunction with PIT tag study data later in 2002 to assist in locating and documenting salmon spawning activity.

b. Water Quality

Water temperature data loggers were deployed from May to October at nine sites in the Penobscot basin. Loggers were placed in the East Branch Penobscot and two of its tributaries, the Big Seboeis River and Wassataquoik Stream. The Mattawamkeag River, upper Piscataquis River, Pleasant River, and Kingsbury stream were also monitored. These data will contribute to the time series dataset and be used to help assess habitat suitability and the potential impact of water temperature regime on the growth and survival of juvenile Atlantic salmon. Preliminary review of the 2002 data indicates marked improvement over the harsh drought observed in 2001.

4. Fish Passage

a. Monitoring Fishways.

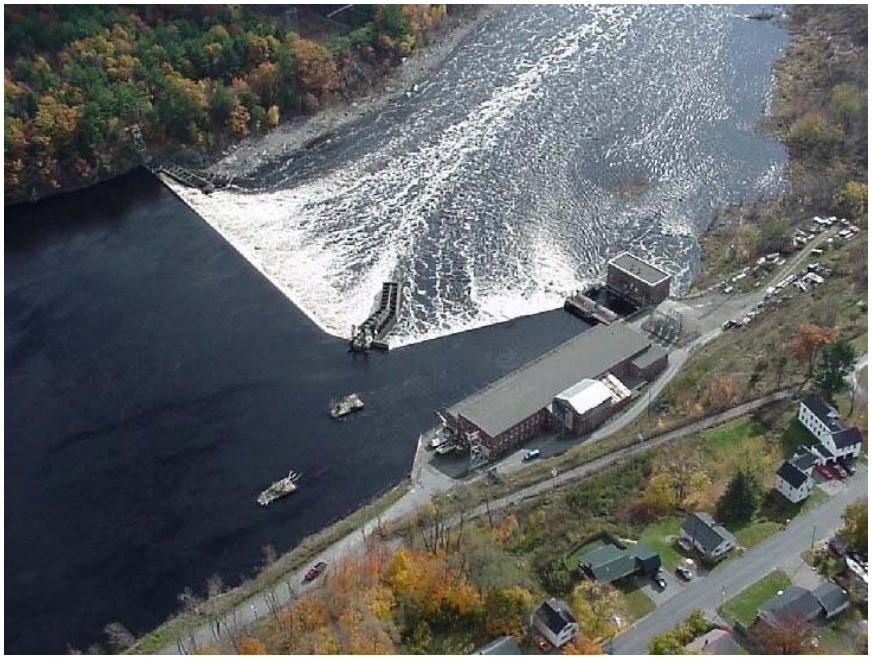
Effective fishway operation is essential for returning salmon to pass dams and access headwater spawning areas. Fishways were inspected on a routine basis in 2002 in conjunction with a PIT tag study, which required biologists to visit fishways twice each week to download data and maintain equipment. Fishways were inspected on a routine basis in order to ensure proper operation and confirm operator compliance with appropriate maintenance procedures. Inspections were routinely conducted at four dams in the Piscataquis (Howland, Browns Mill, Moosehead Manufacturing, and Guilford Industries), the Lowell Tannery Dam on the Passadumkeag, and five main stem Penobscot dams (Veazie, Great Works, Milford, West Enfield, and Weldon). Each site was inspected an average of 20 times, with a total of 184 inspections conducted in 2002. Improper fishway maintenance and operation practices were rare, relatively minor in nature, and were corrected by the owners upon request.

Penobscot PIT tag Project

The year 2002 marked the beginning of a cooperative research project between the Maine Atlantic Salmon Commission (ASC), USGS (Conte Anadromous Fish Research Center), U. S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and the Penobscot Indian Nation (PIN). The study is investigating the temporal and spatial movements of Atlantic salmon during their upstream migration in the Penobscot River basin using PIT tags (Passive Intermittent Transponder). PIT tag antenna arrays and data loggers were installed at the entrance and exit of fishways at five main stem dams (Veazie, Great Works, Milford, West Enfield, and Mattaceunk) and three Piscataquis drainage dams (Howland, Dover-Foxcroft, and Browns Mills). Of the 402 salmon returned to the river following trap capture at the Veazie dam in 2002, 378 were tagged with 22 mm PIT tags using a safe method of injection that we developed. ASC contract personnel downloaded remote fishway PIT tag antenna data loggers twice weekly, imported data into a Microsoft Access relational database, and will be actively auditing and analyzing data for fish movement patterns during the winter months. Fish passage will be related to season timing, photoperiod, river flow, and temperature, along with final destinations tagged fish. The project's results so far have exceeded our expectations, showing this project to be a baseline study for future years.

b. Fish Passage Consultation and Review

ASC staff met with the owners (BPHA) of the West Enfield dam to review results of their new computational flow dynamics (CFD) model. The model indicates that increasing flow may not be an effective solution to enhancing downstream fish passage there, and a variety of other alternative proposals are currently being considered. Staff also consulted with GLHA regarding downstream passage issues at the Weldon dam. The ASC and other agencies agreed that studies should be post-phoned until 2003 due to mechanical problems with turbines that would have strongly biased study data. The Matagamon Lake Association was advised on repairs to the Matagamon Dam fishway, and ASC staff participated in repair efforts.



Pleasant River

The Pleasant River is located in Washington County. It originates in Pleasant River Lake and flows approximately 45 km to the head of tide in Columbia Falls. Tributaries include the Eastern Little River, Western Little River, and Bog Brook. The National Marine Fisheries Service (NOAA-FISHERIES) and the U. S. Fish and Wildlife Service (USFWS) listed the Atlantic salmon population as endangered on November 13, 2001. The ASC conducted the following enhancement and management activities on the Pleasant River in calendar year 2002.

1. Population Monitoring

a. Adult Weir Operations

We operated a weir, located upstream of the Route One bridge, from May 16 to November 9 to trap upstream migrating adults for the purposes of evaluating the size of the wild adult run and to intercept suspected escaped aquaculture fish. We did not capture any salmon in 2002.

b. Electrofishing

ASC personnel electrofished four sites in the Pleasant River drainage to estimate parr abundance using multiple pass depletion estimates. Very low adult returns in recent years coupled with no stocking has led to exceedingly low numbers of juvenile salmon in the Pleasant River. We did not capture any parr in 2002. However, we did capture a small number of young-of-the-year, probably the progeny of the adult returns in 2001. Nevertheless, the population in the Pleasant River is critically low.

c. Redd Counts

We conducted redd surveys on the lower reaches (from Saco Falls to the Route One bridge) of the Pleasant River, Crebo Flats area on the main stem, and the lower Western Little River. We did not find any redds on the Pleasant River in 2002. This is not surprising because we also did not document any adult returns this year. Redd counting on the Pleasant was difficult as always, due to the very dark nature water.

2. Population Enhancement

a. Stocking

Salmon were again stocked into the Pleasant drainage in 2002 after a period of years with no stocking. We stocked 13,500 0+ parr in optimal habitat below Saco Falls and at Crebo Flats in late September 2002. These parr are a component of a smolt-stocking program that has been instituted for the Pleasant. The first smolts will be stocked in spring 2003.

b. Broodstock Collection

NOAA-Fisheries and ASC collected four smolts with the rotary screw smolt trap located in Columbia Falls. All were transferred to the captive broodstock program at Craig Brook National Fish Hatchery. We did not attempt to collect broodstock via electrofishing due to the very low numbers of fish in the river.

3. Habitat

b. Habitat Survey

The Pleasant River habitat survey has been completed and no new work was done in 2002.

c. Embededness Survey

We initiated a survey of substrate embededness on the Downeast salmon rivers. This method estimates the degree to which stream substrate has been filled in with fine sediments. High embededness (or low Interstitial Space Index "ISI") has been shown to be negatively correlated with salmonid populations, as well as other organisms such as insects. We measured embededness at Crebo Crossing (ISI = 0.89) for baseline data in anticipation of habitat improvement work to be performed there.

d. Water Quality

The ASC recorded water temperatures with automated temperature loggers at eight sites through out the drainage. Five sites will continue to be monitored during the 2002-2003 winter. In the summer of 2002 we recorded weekly average temperatures exceeding 25ºC at one site and we recorded peak temperatures exceeding 30ºC at two sites. We are nearing completion of populating a water temperature database with a large collection of older data, as well as contemporary data. This database will allow us to access water temperature data efficiently, perform temporal and spatial analyses, and distribute data easily.

4. Public Meetings and Outreach

ASC staff attended meetings of the Pleasant River Watershed Council, Downeast Watershed Coalition, Downeast Salmon Federation, and Project SHARE. All of these organizations work on salmon habitat and riparian habitat issues in the Pleasant River watershed.

Saco River

The Saco River watershed drains an area of 4,395 square kilometers (km) of which 2,253 square km are located in east-central New Hampshire and 2,142 square km in southwestern Maine (York and Oxford counties). The Saco River flows from its headwaters in the White Mountains of New Hampshire 64 km to the Maine border in Fryeburg were it flows an additional 137 km to the Atlantic Ocean in Saco and Biddeford. It has two large tributaries in Maine, the Ossipee and Little Ossipee rivers. The Saco River has a small Atlantic salmon population currently maintained by annual releases of hatchery stocks and limited natural reproduction. In an effort to manage and restore Atlantic salmon to the Saco River, the Atlantic Salmon Commission (ASC) and stakeholders conducted the following activities in 2002.

Activities

1. Population Monitoring

a. Adult Traps

Florida Power and Light (FPL) currently operates three fish passage-monitoring facilities on the Saco River. The Cataract fish lift, located on the East Channel in Saco was operational from early May to late October. This year 11 salmon were lifted and passed into the Cataract head pond from this facility. On the West Channel in Saco and Biddeford, the Denil fishway and fish sorting facility was also operational from early May to late October. This facility passed 36 salmon into the head pond. A third passage facility at Skelton Dam was used to capture adult salmon for transport to the Ossipee River. FPL transported and released 27 salmon from this facility.

b. Electrofishing

The ASC, in cooperation with the Saco River Salmon Club (SRSC) and FPL, sampled 11 sites on 10 tributaries throughout the Saco River drainage. Nine sites were evaluated using a two or three-pass depletion method and two were assessed with a single measured pass method. A copy of this data can be obtained by contacting the ASC offices in Sidney.

c. Redd Counts

No redd survey was completed in 2002 due to high flows and early freeze-up.

2. Population Enhancement

a. Stocking

The SRSC and ASC stocked approximately 576,644 Atlantic salmon fry in the Saco River drainage in May 2002. Half of the fry were stocked into the Ossipee River and the remaining in 24 tributaries. These fry were all produced from eyed eggs provided to the SRSC by the ASC.

3 Habitat

Habitat Surveys

The ASC worked with SRSC volunteers to establish an Atlantic salmon habitat survey program on tributaries to the Saco River. Berry Brook and Pease Brook were habitat surveyed during summer 2002.

4. Meetings

a. Saco River Salmon Club

ASC staff attended monthly meetings in an effort to exchange information and keep informed on Club activities.

b. Skelton and Bar Mills Facilities

The ASC staff attended meetings concerning the operational protocol for the new Skelton fish passage facility and its dedication ceremony. We also attended re-licensing meetings for the Bar Mills Hydro Project.

Sheepscot River

The Sheepscot River drains portions of Kennebec, Waldo, and Lincoln counties. The main stem, originating in West Montville, flows 55 kilometers (km) to the head of tide in Alna. The West Branch originates at Branch Pond and flows 24 km to its junction with the main stem in Whitefield. The second largest tributary, the Dyer River, empties into the Sheepscot River estuary at the Town of Sheepscot. The National Marine Fisheries Service (NMFS) and the U.S. Fish & Wildlife Service (USFWS) listed the Atlantic salmon population in the Sheepscot River as endangered on November 13, 2000. ASC staff, along with various stakeholders, conducted the following enhancement and management activities in 2002 on the Sheepscot River.

1. Population Monitoring

a. Electrofishing

Six index sites were electrofished by ASC staff to assess juvenile Atlantic salmon populations. Three sites were in the West Branch and three in the main stem. A copy of this data can be obtained by contacting the ASC.

b. Smolt Trapping

ASC and NMFS, with help from the Sheepscot River Watershed Council (SRWC), continued its smolt-trapping program at the Head Tide Dam in Alna to assess emigrating salmon smolts. All smolts caught were sampled for biological information and released.

c. Calcein Marking

ASC, SRWC, and USFWS personnel used calcein to experimentally mark 25,000 fry stocked into the West Branch of the Sheepscot River as a continuation of research started in 2001. The object of the study is to evaluate mark retention and stocked fry performance. Calcein is a fluorochrome compound that chemically binds to the calcium in bony structures of fish and can be seen with the aid of special optical filters. Fry were immersed in a calcein bath for approximately three minutes facilitating the uptake of calcein, prior to stocking. Marked fry were stocked in the West Branch along with equal numbers of unmarked fry to evaluate the effectiveness of the mark. When these fish are recaptured as large parr, it hopeful that it will be possible to determine the effectiveness of the mark and its potential for use in research and management. Four electrofishing crews captured fry over a two-day period in late summer. A copy of this data can be obtained by contacting the ASC.

d. Redd Counts

Spawning habitat was surveyed for redds by ASC staff between November 4 and December 4, 2002. Two surveys were conducted on the West Branch of the Sheepscot River from Upper Dear Hill Road to the Dirigo Road. Only one complete and one partial survey were done on the main stem from the Palermo Fish Rearing Station to Head Tide due to high water and ice conditions. In addition, one survey was completed below the Hostile Valley Rd above Sheepscot Pond. Four redds were found, one on the West Branch, one below the Palermo Fish Rearing Station and two at Coopers Mills.

2. Population Enhancement

a. Stocking

ASC and USFWS stocked 200,000 river specific Atlantic salmon fry in the Sheepscot River during 2002.

b. Brood Stock Collection

ASC and USFWS collected 168 parr by electrofishing for transfer to the captive river specific brood stock program at the Craig Brook National Fish Hatchery.

3. Habitat

a. Habitat Surveys

The ASC conducted Atlantic salmon habitat surveys on the main stem of the Sheepscot River above Sheepscot Pond to determine the amount of habitat that exists for adult spawning and juvenile rearing. The survey encompassed approximately 10 miles of riverine habitat.

b. Obstruction Survey and Removal

ASC staff surveyed the main stem Sheepscot River for fish passage obstructions from Coopers Mills to Whitefield on October 21 and 22. Also, we surveyed the West Branch on October 22 from Maxcys Mills to the main stem of the Sheepscot River. All beaver dams found were breached to facilitate salmon passage.

c. Temperature Monitoring

The Sheepscot Watershed Council placed 11 data loggers throughout the drainage in the summer and fall of 2002 at ASC request. Because winter thermal regime is less variable, only six data loggers were deployed during winter 2001-2002 (Appendix 1).

4. Meetings

a. Watershed Councils

ASC staff attended monthly meetings of the SRWC and meetings associated with passage issues at Coopers Mills.

d. Fish Passage Workshop

ASC staff attended a two-day fish passage workshop hosted by the Maine Department of Transportation (DOT). The workshop covered various issues including the DOT Fish Passage Policy and Design Guide and current fish passage technology.

Souadabscook Stream

The Souadabscook Stream is located in Penobscot County. It flows approximately 35 km from its source at Etna Pond in the towns of Etna and Carmel to its confluence with the Penobscot River in Hampden. The Souadabscook stream drains an area of 203 sq. miles. It has a number of tributaries, the largest being the West Branch. Smaller tributaries include Wheeler Stream, Ward Stream, Black Stream, Harvey Brook, Tracey Brook, and Hill Brook. Souadabscook Stream had four small dams in the recent past: one hydro dam and three small flow control dams. Two of these are still present but one has a slot cut into it to allow a year round concentrated flow. The second dam is located above the Emerson Mill Road and is passable at normal flows. The ASC conducted the following enhancement and management activities on Souadabscook Stream in 2002.

1. Population Monitoring

a. Electrofishing

Three electro-fishing sites were sampled on Souadabscook Stream. The lower site was sampled in August during extreme low water levels. Only one salmon parr was found at the Laskey Lane site and at the recreation area site, salmon were caught and sampled in low densities. This data will be further analyzed during winter 2002-2003 and additional information will be available from the ASC in early spring.

b. Redd Counts

There were three attempts to find redds on Souadabscook Stream in 2002: (October 29, November 13, November 20) but no redds or redd-digging activity was found.

2. Habitat

a. Obstruction Surveys and Removal

A number of fish passage problems (six) were recorded on the main stem below the Emerson Mill Rd. and Rte. 1 in Hampden. The effect of these obstructions was compounded by excessively low river flows throughout early fall. Two beaver dams were breached on one occasion through the section between recreation area and Rte. 1 to provide some moving water attraction through the lower river. These dams were not rebuilt during the migration run. Dams above this area were only breached once due to the fact that fish could not get over the falls above the Hampden Recreation Area until after October 17 when water levels rose and passage was not a problem.

b. Water Quality

ASC recorded summer water temperature on the Souadabscook Stream at three sites: below the Emerson Mill Rd Bridge, Hampden Recreational Area, and at Laskey Lane. MDEP also collected water quality data from Souadabscook Stream. Water temperature data is also being recorded by the ASC from one location over winter. All data will be analyzed during the winter 2002-2003 and will be available in early spring.

St. Croix River

The St. Croix is the easternmost river in the United States, and forms the Canadian-U.S. boundary from southern Aroostook to Washington counties. The East Branch from Vanceboro to Grand Falls flowage, and the main stem from there to Calais are the focus of current Atlantic salmon restoration efforts. The West Branch, which joins the East Branch to form the main river at Grand Falls Flowage, is intensively managed for inland game fish by IFW and not actively managed for Atlantic salmon. The production potential is estimated to be between 900 and 2600 adult fish and the 10-year restoration goal is for a spawning escapement of 300 mature fish. The St. Croix International Waterway Commission (SCIWC), Canadian Dept. of Fisheries and Oceans (DFO), New Brunswick Dept. of Natural Resources (NBDNR), NOAA Fisheries, USFWS, IFW, DMR, and other stakeholders cooperated with the ASC to conduct the following enhancement and management activities in 2001.

1. Population Monitoring

a. Adult Trap Operations

Milltown Dam. Adult salmon are monitored via a fishway trap operated by the SCIWC at the Milltown dam, near the head of tide. This facility provides an opportunity to enumerate and sample returning adults, collect broodstock, screen for ISAV (infectious salmon anemia virus), and prevent aquaculture escapees from entering the river. The 2002 Milltown trap catch of 20 sea-run salmon (13 1SW and 7 MSW) was 28% below the 5-year mean, and 72% below the 10-year mean. The decline is attributed to poor marine survival and reduced smolt stocking in recent years. Aquaculture escapees have been a prevalent component of the trap catch since 1994 (the first year these data were reported) and accounted for over 70% (56 fish) of the total catch in 2001. Only six aquaculture fish were observed in 2002 following complete depopulation of all Cobscook Bay salmon pens in 2001 to control the spread of ISA. Complete biological data are recorded for all aquaculture escapees prior to destruction of those fish.

b. Electrofishing

ASC and Canadian biologists surveyed multiple sites in 2002 encompassing a 33 km section of prime salmon habitat where abundant spawning was observed in 2000 and 2001. Mean one-run densities of young-of-the-year (YOY) salmon remained low but did increase by 100% (0.62 vs. 0.32 YOY $100m^{-2}$) relative to 2001. Parr were rare.

c. Redd Counts

No adult salmon were stocked or released into the St.Croix River in 2002. Redd counts were attempted to determine if adult salmon stocked in previous years had remained in the river and spawned in 2002. Flow management constraints on the St. Croix resulted in high flows (1200 – 1400 CFS) throughout the spawning season and most of the redd counting window. A 4-person team surveyed Palfrey Stream and spawning shoals at Vanceboro and Mile Rips. Small redds presumed to be dug by landlocked salmon were observed at all locations, but no redds attributable to Atlantic salmon were observed.

d. Smolt Trapping

The ASC assisted the SCIWC and the NOAA Fisheries with site selection and installation of a rotary-screw smolt trap (RST). This goal of this year's RST program was to refine site-specific application of this technique in the St.Croix system. RST will be deployed in 2003 and 2004 to evaluate smolt production from the experimental adult stocking program.

e. Fry Trapping

The low densities of juvenile salmon observed in 2001, and poor fry trapping results from the Dennys River, prompted concern over the viability of the eggs and redds produced by the sea-caged reared adults. Traps designed to capture emergent fry were deployed over 12 redds in the St.Croix during the spring of 2002 to evaluate redd viability, over-winter survival, and provide an estimate of fry production. Fry emerged successfully from all but one of those redds, and were abundant (> 800 fry/redd) at two of the three areas where traps were deployed. These data combined with redd count data suggest over 250,000 fry were produced by the captive-reared adults stocked the previous year.

2. Population Enhancement

Juvenile Salmon. Since 1996 all sea-run salmon captured at the Milltown trap have been retained for broodstock. Broodstock is held in onsite holding tanks pending pathology screening (ISAV, etc.), and then transported to the DFO Mactaquac Biodiversity Facility for spawning. All fish have tested negative for ISAV since screening was initiated in 2000. Fry produced from these broodstock are returned in the spring to the Milltown dam site, reared in onsite tanks until fall, and released as 0+ age parr. This fall 16,000 parr were released, compared to a record high of 124,000 parr in 1997. Smolt stocking has typically ranged from 20,000 to 50,000 smolts annually. Declining returns to the Penobscot River, the primary parent stock for the St.Croix enhancement program, and the decommissioning of the Saint John Hatchery have greatly reduced the availability of smolts (and parr) in recent years. Only 8,000 smolts were released in 2001, and a single group of 4,000 smolts was released in 2002 for research purposes

Adult Salmon. There was no adult Atlantic salmon spawning escapement in the St. Croix in 2002. All salmon captured at the Milltown trap were retained for broodstock and there was no experimental adult stocking program in 2002.

3. Habitat

The ASC deployed water temperature data loggers at three sites in conjunction with fry trapping operations and a variety of water quality monitoring activities were undertaken by the SCIWC. These data are currently being analyzed.

4. Fish Passage

Alewives remained the focus of fish passage issues on the ST. Croix in 2002. Alewives are a native species of the St. Croix ecosystem and may play an important role as a "diversionary" prey item in reducing depredation of migrating salmon smolts. Alewives have been denied access to Spednik Lake since 1987 at the request of IFW. The IFW were concerned that high alewife abundance might be contributing to the concurrent declines observed in the Spednic Lake smallmouth bass *Micropterus dolomieui* population. In 1991, Fisheries agencies agreed to also close the Grand Falls fishway (for three years), later extending the closure for an additional year to facilitate ongoing research. The Maine State Legislature passed legislation in 1995 to keep the Spednik Lake, Grand Falls, and Woodland fishways closed to alewives indefinitely, thus eliminating access to 99% of the alewife spawning habitat. By 2000, the run had declined to fewer than 9,000 alewives. In response to this decline the St. Croix Fisheries Steering Committee, which includes an ASC representative, reached a compromise for reopening the fishways but with a conservative spawning escapement of 90,000 alewives (4 fish/acre) above Grand Falls. The Maine State Legislature considered and rejected legislation to reopen the Grand Falls and Woodland fishways in 2001. The DFO responded by trapping and trucking alewives from the Milltown trap to spawning habitat in the Woodland head pond dam in 2001 and 2002. Due to extremely poor returns, the number of alewives trucked in 2001(3,756) and 2002 (807) was a small fraction of the 90,000 required for management objectives. The USFWS had voiced opposition to closure of these fishways, which were constructed with contributions of USFWS funds, and felt that it violated the terms of the fishway construction grants. In November 2002, the USFWS acknowledged that their 25-year vested interest in the dams had expired.

Tunk Stream

Tunk Stream is located in Hancock and Washington Counties. It originates in Tunk Lake and flows approximately 26 km to Gouldsboro Bay in Steuben. Spring River Lake is another major lake in the drainage. The Atlantic salmon population is believed to be extinct. Salmon were present in Tunk Stream at least through the 1980s. The proximity of Tunk Stream to the Narraguagus River, as well as other Downeast salmon rivers, and its history as a self-sustaining salmon river, make it a candidate for experimental introductions. Tunk Stream lies within the Distinct Population Segment defined in the 2000 Endangered Species Act listing of Maine Atlantic salmon. However, Tunk Stream was not one of the eight rivers specifically listed. The ASC conducted the following enhancement and management activities on Tunk Stream in 2002.

1. Habitat

a. Habitat Survey

We completed a habitat survey of the entire length of the main stem of Tunk Stream in 2002. This survey will be added to the GIS salmon habitat database in 2003. Future management or research will depend on knowledge of the habitat in Tunk Stream. This habitat survey will be useful in future decision-making regarding Atlantic salmon management in Tunk Stream.

2. Public Meetings and Outreach

ASC staff attended meetings of the Downeast Watershed Coalition, Downeast Salmon Federation, and Project SHARE. All of these organizations work on salmon habitat and riparian habitat issues in the Tunk Stream watershed.

Union River

The Union River is the 19th largest River in Maine, draining 500 square miles of Hancock and Penobscot Counties before entering the sea in downtown Ellsworth. During the 1980's Atlantic salmon management in the Union drainage consisted of an annual smolt stocking and adult broodstock collection program. This program was discontinued after 1990 due to a lack of resources and unfavorable results. The current Union River salmon management program is a cooperative effort between the USFWS, the Pennsylvania Power and Light Company (PPL), Union River Association and the ASC. The following management activities were undertaken in 2002.

1. Population Monitoring

a. Adult Trap Operations

Ellsworth Dam. The Ellsworth dam is 65 feet in height and is not equipped with an upstream fishway. The current dam owners, PPL, provide fish passage by trapping fish below the dam and transporting them in tank trucks to upriver release sites. The trap is owned by the ASC but is operated in early spring by commercial fishermen who are permitted to harvest a portion of the alewives entering the trap. Alewives were abundant in 2002 and PPL successfully transported the target-spawning escapement (100,000 alewives) to upriver spawning areas. No salmon were captured during the alewife harvest in 2002.

The primary objective of operating the Union River trap-and-truck program is to transport returning adult salmon upriver past two impassable dams and into suitable spawning habitat where they may contribute to juvenile recruitment. Secondary objectives include collection of biological data and monitoring of marked recaptures from study groups. Standard ASC protocol dictates that Trap-and-Truck operations for salmon must be suspended to reduce fish-health risks when the water temperature at the release site exceeds 22°C (appendix 1). Water temperatures in the Union River exceeded the 22°C threshold on 95% of the days (57/60) between June 28 and August 28, 2001. Operation of the trap for Atlantic salmon passage was consequently reduced to 19 days in 2001 (the trap was operated for commercial alewife harvesting from 5/11 to 6/18).

The ASC recommended that trapping (but not trucking) should continue when river temperature exceeded the 22°C threshold at the Union trap in 2002 to gain insight into trapping success and fish behavior during periods of high river temperature. A total of five sea-run salmon and six aquaculture escapees were captured in 2002. One of the five sea-run salmon was captured when water temperature exceeded 22°C, and was returned to the river immediately to avoid further stress. The other 4 sea-run salmon were captured during cooler periods and were trucked to up-river spawning areas. ASC staff lethally sampled one of the aquaculture fish and the remainders were returned to the river below the dam.

2. Population Enhancement

a. Stocking

Juvenile Salmon. The Union River Salmon Association (USA) modified the hatchery water filtration system in 2002 prior to receipt of salmon eggs in an effort to correct problems that

resulted in 100% fry mortality in 2001. Eyed eggs were received from the GLNFH and were successfully incubated until hatch. Unfortunately, all fry died with 48 hours of hatching. Results from necropsies performed by IFW fish health experts implicated high bacteria levels and an inadequate water filtration. Water samples were collected from within the hatchery, and from the adjacent Union river where the hatchery intakes are located. Dissolved iron levels in both samples exceeded the acceptable threshold for hatchery production water. The USA is currently evaluating alternative water sources for the hatchery. The ASC will withhold providing salmon eggs in future until the USA facility has proven to be suitable for hatching eggs and holding fry in satisfactory condition.

3. Habitat

Habitat data collected for the West Branch in 2001 are currently being analyzed. No additional habitat surveys were conducted in 2002.

4. Redd Counts

The 2001 habitat survey identified prime spawning habitat near the adult release site and Mariaville Falls. This area was thoroughly inspected on foot under ideal conditions but no redds were observed. We also inspected some spawning shoals above the Tannery Loop Road Bridge but did not find any redds.

APPENDIX

Appendix 1

Salmon River Temperature Data

The Atlantic Salmon Commission, in cooperation with Federal agencies and Watershed Council volunteers has been monitoring water temperature in Maine Rivers for more than ten years. The purpose is to determine the thermal characteristics of what seems to be good physical habitat. Juvenile Atlantic salmon grow throughout spring, summer, and fall. The best young salmon growth occurs when temperatures are between 16° C and 18° C. Feeding ceases as temperatures fall below 7 ° C or increase above 22 ° C. However, even at daytime temperatures near 23° C salmon can survive if nighttime cooling brings water temperatures below 22 ° C. Stressful thermal conditions often occur in August on Maine salmon streams because it is the month typically having the warmest weather. Analyses of the data have been limited by our ability to compile and integrate data from our cooperators. Major changes in the structure of the database used to manage the data during 2001 and 2002 have improved our ability to compile and analyze data from a number of sources. August 2001 maximum and minimum temperatures were extracted for a variety of rivers and are presented in Figures 1, 2 and 3. There was only one river reach in 2001 for which the thermal regime for the month was unsuitable for juvenile salmon growth. That site was at Manning Mill on Souadabscook Stream, a tributary to the lower Penobscot River.

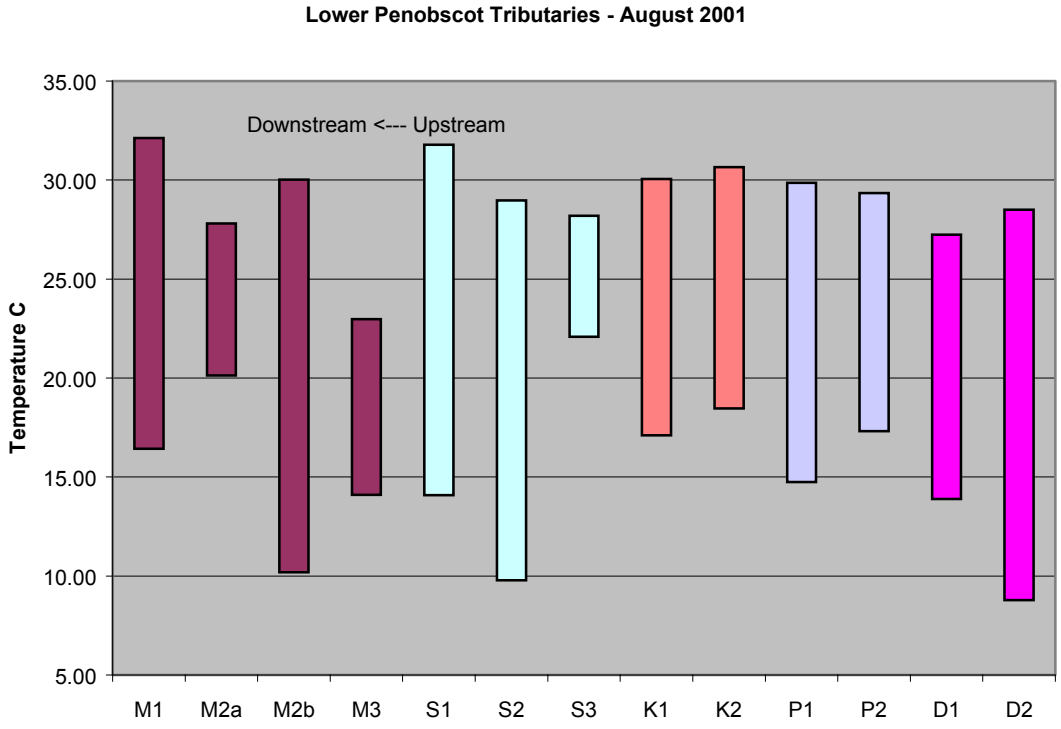


Figure 1. August 2001 maximum and minimum temperatures for 13 sites on lower Penobscot River Tributaries. M = Marsh Stream, S = Souadabscook Stream, K = Kenduskeag Stream, P = Passagassawakeag River, D = Ducktrap River. Within each tributary, lower numbered sites are downstream.

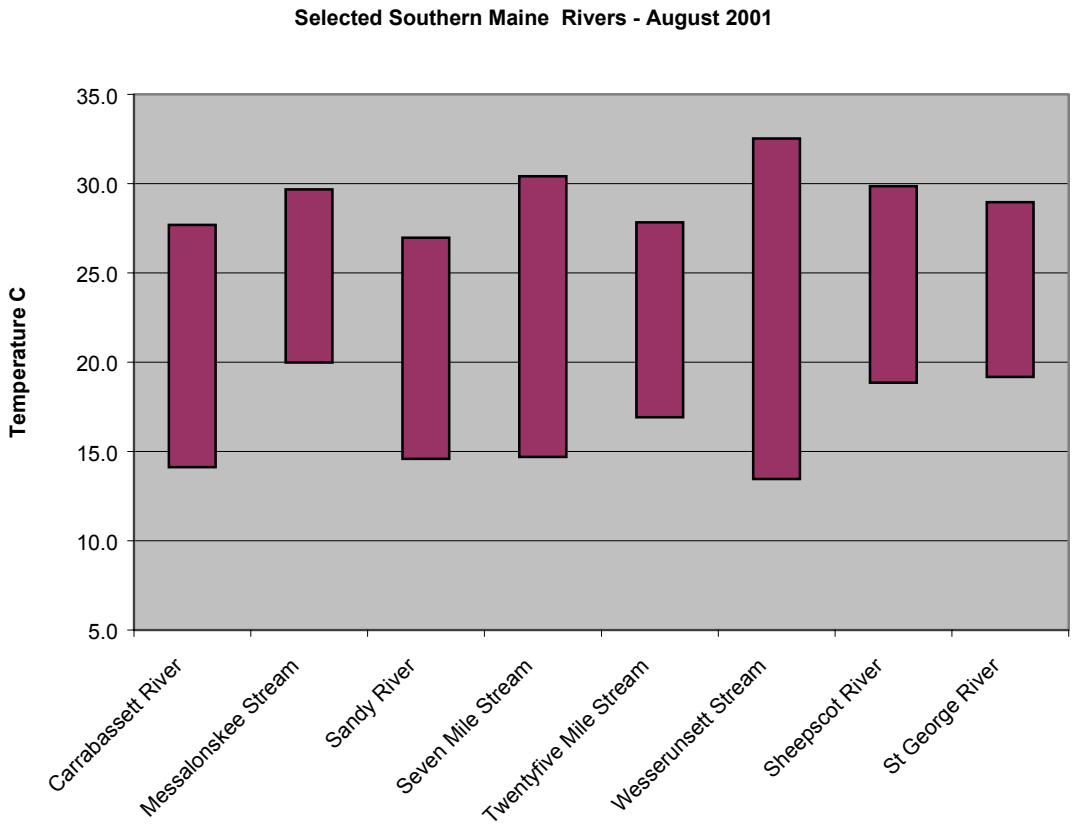


Figure 2. August 2001 maximum and minimum temperatures for main-stem portions of selected southern Maine rivers.

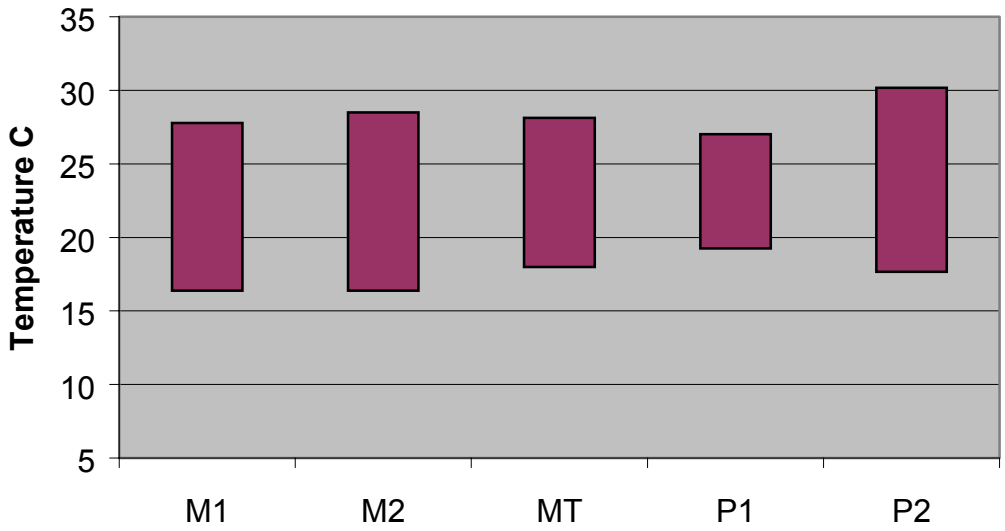


Figure 3. August 2001 maximum and minimum temperatures for sites in the Machias River (M) and Pleasant River (P) watersheds. Lower numbered sites are downstream. MT = Mopang Stream, a tributary to the Machias River.

Appendix II

Atlantic Salmon Commission
Public Advisory Panel

Name	Watershed	Affiliation
Gary Arsenault	Penobscot	Eddington Salmon Club
John Banks	Penobscot	PIN
Mike Butler	Cover Brook	Cove Brook Watershed Council
Marshall Demott	Kennebec	Kennebec Fly Fishers
Ken Castner	Saco	Saco Salmon Club
Scott Dickerson	Ducktrap	Ducktrap Coalition
Jo Eaton	Penobscot	Penobscot River Keepers
Tim Foster	Penobscot	Veazie Salmon Club
Mike Herz	Sheepscot	Sheepscot Valley Conservation Assoc.
Bob Hinton	Dennys	Dennys River Watershed Council
Bill Nichols	Presumpscot	Saco Salmon Club
Greg Ponte	Androscoggin	Androscoggin Watershed Council
Gary Sewell	Aroostook	Atlantic Salmon for Northern Maine
Matt Scott	Pleasant	Pleasant River Watershed Council
Donald Sprangers	East Machias	East Machias Watershed Council
Tom Whiting	St. George	Trout Unlimited
Barbara Witham	Union	Union Salmon Association
Gerry Zegers	Machias	Machias Watershed Councils

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